



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

University of Wisconsin
LIBRARY

Class **SVP**
Book **.N51**

✓



1000

1000

1000

1000

1000

THE INTER-OCEANIC CANAL OF NICARAGUA

ITS HISTORY
PHYSICAL CONDITION
PLANS AND PROSPECTS

PUBLISHED BY THE NICARAGUA
CANAL CONSTRUCTION COMPANY

.

WARNER MILLER · PRESIDENT

NEW YORK
1891

THE NEW YORK PRINTING CO.,
(THE REPUBLIC PRESS.)
536 and 538 Pearl Street, New York.

40102
13 N '96

SVP

N51

TABLE OF CONTENTS.

THE MARITIME CANAL OF NICARAGUA.

	PAGE
CHAPTER I. ITS HISTORY, - - - - -	3
II. PHYSICAL CONDITION OF COUNTRY TRAVERSED, - - - - -	19
III. CLIMATE, - - - - -	33
IV. THE PROPOSED CANAL. THE ROUTE AND DESCRIPTION OF THE WORK,	35
V. THE WORK ACCOMPLISHED, - - - - -	43
VI. FINANCIAL ASPECT OF THE ENTERPRISE, - - - - -	59

APPENDIX.

I. UNITED STATES CHARTER, - - - - -	1
II. NICARAGUA CONCESSION, - - - - -	4
III. COSTA RICAN CONCESSION, - - - - -	18
IV. DICKINSON-AYON TREATY, - - - - -	33
V. FRELINGHUYSEN-ZAVALA TREATY, (NOT RATIFIED), - - - - -	36
VI. THE NICARAGUA CANAL, BY SENATOR JOHN SHERMAN, - - - - -	43
VII. SPEECH OF HON. JOHN T. MORGAN, - - - - -	43
VIII. REPORT OF CONSULTING ENGINEERS, - - - - -	69
IX. VOLCANOES AND EARTHQUAKES, - - - - -	73
X. STATEMENT BY HON. WARNER MILLER, - - - - -	79
XI. REPORT OF CHIEF SURGEON, - - - - -	83

LIST OF ILLUSTRATIONS.

BIRDS-EYE VIEW OF CANAL, - - - - -	FRONTISPICE.
CASTILLO, THE RIO SAN JUAN, - - - - -	FACING PAGE 19
ENGINEERING PARTY'S CAMP, - - - - -	" " 33
BREAKWATER AT SAN JUAN DEL NORTE, - - - - -	" " 35
DREDGES WORKING IN THE CANAL, - - - - -	" " 43
DREDGES, EMBANKMENT AND RAILROAD TRAIN, - - - - -	" 59
WORLD CHART WITH SAILING ROUTE, - - - - -	" " 76
STOREHOUSE AND QUARTERS AT LA FÉ, - - - - -	FACING APPENDIX PAGE 4
RAILROAD BUILDING THROUGH SWAMP, - - - - -	" " " 33
LAKE NICARAGUA AND OMETEPE, - - - - -	" " " 43
DIAMOND DRILL BORING PARTY, - - - - -	" " " 43
CATHEDRAL OF RIVAS, - - - - -	" " " 73
MARKET IN GRANADA, - - - - -	" " " 73
HOSPITAL BUILDINGS, - - - - -	" " " 83

SOME CHAPTERS ON
THE MARITIME CANAL
•OF•
NICARAGUA.

"In accordance with the early and later policy of the Government, in obedience to the often expressed will of the American people, with a due regard to our national dignity and power, with a watchful care for the safety and prosperity of our interests and industries on this continent, and with a determination to guard against even the first approach of rival powers, whether friendly or hostile, on these shores, I commend an American Canal, on American soil, to the American people and congratulate myself on the fact that the most careful explorations have been started, and that the route standing in this attitude before the world, is the one which commends itself as a judicious, economical and prosperous work."—*General U. S. Grant in North American Review, Feb. 1881.*

THE MARITIME CANAL OF NICARAGUA.

CHAPTER I.

ITS HISTORY.

The problem of Inter-oceanic Communication by a water-way across the Isthmus that connects North and South America and, at the same time, separates there the Atlantic and Pacific oceans, which, since the time of Columbus, has excited the interest and stimulated the enterprise of the civilized world, has been gradually narrowed through the process of elimination, or more justly speaking, by the survival of the fittest, from a multitude of theoretical solutions, to the question of the possibility, the feasibility and the advantages of such a communication, by the way of the San Juan River and Lake Nicaragua, through the territory of the Republic of Nicaragua.

As early as the year 1550 Antonio Galvao indicated this route as one among those regarded by him as most available; many others have since been suggested, investigated and their availability discussed, but since 1879, attention has been centered, from time to time, upon three of the suggested solutions of the problem. Two of these are now conceded to be impracticable, while the demonstration of the entire feasibility of the third becomes continually more and more conclusive, and its practical realization more certainly assured.

One eminent man, having gained well-deserved fame and prestige by the accomplishment of engineering works in our own country, of great advantage to the nation and people, boldly proposed the transportation upon wheels, of deep sea vessels of the largest size across the Isthmus of Tehuantepec. The prestige gained by his successful opening of the Mississippi River to deep sea vessels, and the accomplishment of other important engineering works secured to Captain Eads a patient hearing for this bold and novel project, and from 1881 to 1886 his ship railway scheme was urged upon the Congress of the United States for adoption. At the same time most persistent endeavors were made both in America and Europe to launch the project as a private enterprise, but the attempt failed utterly; the common sense of mankind proving in this case a safer guide than the confident assertions of an over sanguine enthusiast. Unfortunately, this principle does not always prevail.

Another great man, one of the most illustrious of the century, having joined the waters of the Mediterranean and the Red Sea, by the construction of a sea level canal, asserted that by no other than a similar means of transit at the Isthmus of Panama, could the demands of commerce for a passage connecting the Atlantic and Pacific oceans be satisfied; and straightway hundreds of millions of money, even double the sum he demanded at first for the accomplish-

ment of the work, were thrust upon him. After the expenditure of a vast amount of treasure, and the sacrifice of thousands of human lives, less than one-fourth the total mass of material requiring removal was excavated; and not only was the problem still unsolved, but it had become manifest that there had been no proper apprehension, from the outset, of the nature and value of its factors, as presented at the locality chosen.

The third scheme for the solution of this problem of inter-oceanic communication has moved less rapidly but more certainly on its way, a full and intimate knowledge of its features has been obtained, and it now commands public attention and interest, with continually increasing assurance of ultimate and satisfactory success. The physical features of the route for a canal by the way of the San Juan River and Lake Nicaragua, have been carefully and minutely studied in all their relations, and have been made the subject of plans, thoroughly elaborated in all details, and of estimates as thoroughly and carefully calculated. Every doubtful question has been closely scrutinized, and competent engineers pronounce the project unembarrassed by any difficulty except that of magnitude, which in this age of magnificent undertakings, is a hindrance only when it advances the cost of construction beyond the limit of remunerative returns.

Omitting reference to earlier and less careful explorations, a rapid retrospect of what has been done during the present century will show how thoroughly the problem has been considered.

Since 1849, the entire field of inter-oceanic communication across the American Isthmus has been thoroughly explored, by individual and by National enterprise, the route by Lake Nicaragua always commanding the attention to which, because of its many and magnificent advantages, it was entitled. It is noteworthy that the first official cognizance of the question by the United States Government, was in connection with this route.

In February, 1825, Señor Don Antonio José Cañas, Minister of the United States from the new republic of Central America, which consisted of the States of Guatemala, Honduras, Salvador, Nicaragua and Costa Rica, then recently liberated from the rule of Spain, addressed a note to the Secretary of State calling the attention of the United States Government to the subject of uniting the Atlantic and Pacific oceans by a canal through the republic of which he was the representative, and inviting participation in the enterprise.

Even at that early time the superiority of the route by Lake Nicaragua was acknowledged, as will be seen by the following extract from Mr. Clay's reply, dated April 18th, 1825 :

"The idea has been conceived of uniting the two oceans by a canal navigation. The execution of it will form a great epoch in the commercial affairs of the whole world. The practicability of it can scarcely be doubted. Various lines for the proposed canal have been suggested, and have divided public opinion. The evidence, tending to show the superiority of the advantage of that which would traverse the Province of Nicaragua, seems to have nearly settled the question in favor of that route."

On the 10th of February, 1826, Mr. Clay, in compliance with a promise given Señor Cañas instructed Mr. Williams, then Chargé d'affaires in Central

America, to make an investigation. He thus writes: "It will at once occur to you to ascertain if surveys have been made of the proposed route of the canal, and if entire confidence may be placed in their accuracy. What is its length, what the nature of the country, and of the ground through which it is to pass? Can the supply of water for feeders be drawn from Lake Nicaragua, or other adequate sources? In short, what facilities do the country and the state of its population afford for making the canal, and what are the estimates of its cost? It is not intended that you should inspire the Government of the Republic of Guatemala with any confident expectation that the United States will contribute by pecuniary or other means, to the execution of the work, because it is not yet known what views Congress might take of it. What the President desires is, to be put into possession of such full information as will serve to guide the judgment of the constituted authorities of the United States in determining, in regard to it, what belongs to their interests and duties."

On the 16th of June, 1826, a contract was entered into between the Central American Government and Mr. A. H. Palmer of New York, for the construction of a canal through Nicaragua with a capacity "for vessels of the largest burden possible." With Mr. Palmer was associated the Hon. De Witt Clinton, the builder of the Erie Canal and at that time Governor of the State of New York; the Hon. Stephen Van Rensselaer, of New York; Monroe Robinson, Esq., President of the Bank of the United States; the Hon. Edward Forsyth, of Louisiana; C. J. Catlett, Esq., District of Columbia, and others. Their surveys and estimates were evidently very inadequate, for they proposed to do the work with a capital of only \$5,000,000. Their scheme failed because of their inability to raise the amount proposed, but the merits of the project were so evident that the King of The Netherlands on his individual account, and as patron of an association of capitalists, took up the matter and sent his envoy, General Ver Veer, to Nicaragua in March, 1829, with full power to treat with the Central American Government. When he arrived political affairs were in a disturbed state, and nothing was accomplished until the Congress of Central America was convened in 1830, when a decree was issued authorizing the construction of the canal and with full provisions for all financial and political relations, this with a view to offering the concession to the association already organized in The Netherlands. The negotiations with the King of The Netherlands were, however, fruitless of results, because of the political disturbances in his own country, which resulted in the separation and subsequent independence of the Kingdom of Belgium.

In May, 1835, the United States Government ordered an inspection by Col. Chas. H. Biddle of the different canal routes then under discussion, commencing with that through Nicaragua, but although Col. Biddle visited Central America the inspection was not made.

In 1837 and 1838 Lieut. John Bailey, a half-pay officer of the British Royal Marines, who had resided in Nicaragua for many years, surveyed a canal route under the orders of the Central American Government. He was thoroughly competent and well equipped for the undertaking, and in its prosecution made many maps and drawings, of which afterward he gave free use, and also of all

the data he had collected, to Mr. John L. Stephens, who was sent by the United States Government in 1839 on a special and confidential mission to Central America. Mr. Stephens made the inspection of the canal route one of the subjects of his report, wherein he embodied the measurements and levels taken by Mr. Bailey, together with an estimate of the cost of construction, which amounted to \$25,000,000. He remarks: "The data given are, of course, insufficient for great accuracy." Lieutenant Bailey's explorations were made chiefly between the Lake and the Pacific Ocean.

In 1844 Don Francisco Castellon of Nicaragua visited France to solicit from the government of Louis Philippe a protectorate over his country and the development of the project of an inter-oceanic canal. Other interests interfered and prevented the realization of his wishes, but he was permitted to solicit the interest and co-operation of Prince Louis Napoleon Bonaparte, then a state prisoner at Ham. The Prince had studied the subject closely, was impressed with its importance, and, responding to the desire of Señor Castellon, embodied his ideas in a letter. On the 8th of January, 1846, the Nicaragua Government gave Prince Napoleon power to organize a company in Europe and informed him that it had been resolved to confer upon the new route for the commerce of the world, the name of "Le Canale Napoleone de Nicaragua." The project received some encouragement from the Prince, and in the same year a pamphlet, entitled "The Canal of Nicaragua, or a Project for the junction of the Atlantic and Pacific Oceans by means of a Canal," was published under his name, but whether he ever had any serious purpose of engaging in the work itself, may be questioned. A significant passage in one of his letters is always to be remembered—"With the name I bear, I must have the light of the throne or the obscurity of the dungeon." On May 25th, 1846, the prisoner escaped from Ham, and it is not unlikely that in the months which followed, the canal project served as a convenient cloak for larger designs. The project was entirely lost sight of, however, in the important events which ensued and culminated in December, 1848, in the election of Louis Napoleon to be President of the French Republic.

About this time, when it became apparent that large territorial acquisitions would be made by the United States, as the result of the Mexican war, Great Britain seized the port of San Juan del Norte, which they afterward named Greytown, the only possible eastern terminus of the canal, on the pretext of protection to their ally, the King of the Mosquitos, a savage ruler of a coast tribe. The Government of Nicaragua earnestly and repeatedly solicited the United States to interfere.

In one of his letters, the Supreme Director of the State of Nicaragua says: "The obvious design of Great Britain in seizing upon the port of San Juan, and setting up pretensions to sovereignty, in behalf of savage tribes within the territories of Nicaragua, is to found colonies, and to make herself master of the prospective inter-oceanic canal, for the construction of which the Isthmus alone has the requisites of feasibility and facility."

In his instructions to Mr. Elijah Hise, appointed Chargé d'affaires from the United States to Central America at that time, Mr. Buchanan, the Secre-

tary of State, says: "The object of Great Britain in this seizure is evident from the policy which she has uniformly pursued throughout her history, of seizing upon every available commercial point in the world whenever circumstances have placed it in her power. Her purpose probably is to obtain control of the route for a railroad and canal between the Atlantic and Pacific Oceans by way of Lake Nicaragua." Secretary Buchanan gave Mr. Hise no definite instructions, but concluded his letter by saying: "The Government of the United States has not yet determined what course it will pursue in regard to the encroachments of the British Government."

Though not empowered to treat, Mr. Hise was so impressed with public sentiment at home, and, upon his arrival in Nicaragua, with the importance to the United States of the right of free transit across the territory of that State, that he assumed authority and requested the appointment, by the Republic, of a Commissioner to open negotiations with him. His request was complied with, and on June 21st, 1849, he met at Guatemala the Nicaraguan Commissioner, Señor Don Buenaventura Selva, and they agreed upon the terms of a treaty; but Mr. Hise's act was disavowed by his government. Another treaty negotiated by his successor, Mr. E. G. Squier, was approved by President Taylor and submitted to Congress.

For various reasons, among others the active and influential opposition of the British Minister, Sir Henry Bulwer, action upon the treaty was postponed until Congress adjourned, and a subsequent session passed with the same result. Sir Henry Bulwer's opposition was occasioned by his desire, formulated in the Clayton-Bulwer Treaty subsequently ratified by the two powers, to have Great Britain associated with the United States in any future relations with Central America, or the inter-oceanic canal.

The treaty was scarcely more than ratified, when it became the fruitful source of controversy. On the part of the United States it had been considered desirable chiefly because it put an end to the obnoxious Mosquito protectorate and to foreign colonization; Great Britain, however, had other views as already indicated. As early as 1857, Lord Napier communicated to his government, the expression of the President of the United States concerning it, as follows: "The President denounced the Clayton-Bulwer Treaty as one which has been fraught with misunderstanding and mischief from the beginning. It was concluded under the most opposite constructions by the contracting parties. If the Senate had imagined that it could obtain the interpretation put upon it by Great Britain it would not have passed."

These misunderstandings have not yet been adjusted, and as recently as 1882-83, were the subject of an interchange of views between the State Departments of the two governments.

In September, 1849, Mr. Squier, acting for and on behalf of Cornelius Vanderbilt, Joseph L. White and their associates, obtained a concession for an inter-oceanic canal. The existence of this grant was recognized in the Clayton-Bulwer Treaty. Under the provisions of the concessionary contract a survey of the route was made in 1850-51 by Col. O. W. Childs of Philadelphia, whose report was referred to Col. Abbott and Major Turnbull, of the United States

Topographical Engineers, and they pronounced the proposed plan feasible. Col. Childs is entitled to credit for pointing out the lowest depression in the Cordillera between the Arctic Ocean and Cape Horn. Through this divide, which he found to be 153 feet above the sea level, he located a route, the main features of which have been incorporated in the final location of the canal through the country between Lake Nicaragua and the Pacific Ocean. Col. Childs' was the first thorough instrumental examination of the whole route, of which a record has been preserved that responds to the demands of engineering science; and its general accuracy has been fully confirmed by all subsequent explorations.

The canal proposed by Mr. Vanderbilt was not built, and after several modifications, made at the instance of the grantees, the concession finally lapsed and was declared forfeited by the Nicaraguan Government. Mr. Vanderbilt and his associates had, however, availed themselves of the collateral privileges which the concession granted, to establish an inter-oceanic transit business by the way of San Juan River and the Lake, which the large traffic with the newly discovered gold region of California, made enormously profitable, until the construction of the Panama railroad furnished a means of transport, more certain, more speedy, more comfortable and less costly than could be supplied by the river steamboats and the stage coaches of the Transit Company.

In 1858, the contract with the Transit Company, as well as that for the canal, work on which was never commenced, having been declared forfeited by the Nicaraguan Government because of non-compliance by the grantees with its conditions, Nicaragua and Costa Rica jointly conferred upon Felix Belly of Paris and a company to be organized by him, a concession for the construction of a canal by the route proposed by Childs.

M. Belly had devoted many years of his life to explorations and to the solution of the Isthmian transit problem. He was an enthusiast concerning the advantages of the Nicaraguan line, but neither his knowledge nor his zeal won success. For several years Central American affairs, especially in Nicaragua, were in a very disturbed condition, and later on the civil war in the United States had a discouraging effect upon the successful inauguration of large enterprises on this continent. Before M. Belly succeeded in obtaining the necessary funds, notwithstanding the favorable disposition of the Nicaraguan Government, his concession lapsed.

In 1852 there was commenced a series of explorations covering the whole of the American Isthmus. Some were undertaken by individual enterprise directed to particular routes, but the more important were under the control and direction of the United States Government, the object being to secure a systematic examination of any and all the routes which presented any possibilities of a practicable solution of the problem. These explorations were carried on with more or less continuity until 1880; every locality possessing any claims for consideration was carefully examined, and data were accumulated for a competent and impartial comparison. The route through Nicaragua was explored in 1872-1873 and made the subject of a thorough report by Commander E. P. Lull, aided by Mr. A. G. Menocal as Chief Engineer.

In all these investigations, public and private, the part taken by the Government of the United States was most prominent. The reports of the several exploring expeditions dispatched by the United States, reflect great credit upon the ability and painstaking diligence of the officers, who contributed to the accomplishment of the work entrusted to them. The reports of all the expeditions organized at that time were not printed until December 20th, 1875.

In 1872, President Grant appointed a commission consisting of Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Capt. C. C. Patterson, Superintendent of the Coast Survey, and Admiral Daniel Ammen, U. S. N., Chief of the Bureau of Navigation; "to examine into, make suggestions and report upon the subject of inter-oceanic ship canal communication." The work was conducted by this Bureau of the Navy department under the personal supervision of Admiral Ammen.

Of the numerous projects for inter-oceanic communication by canal, many were soon seen to be impracticable. Only eight routes were deemed worthy of particular investigation; the length of each route and the altitude of the "divides" traversed were found to be as follows:

Tehuantepec . . .	Length 150 miles, Altitude 855 feet.
Nicaragua . . .	" 169 " " 153 "
Panama . . .	" 41 " " 295 "
San Blas . . .	" 30 " " 1145 "
Caledonia-Tuyra . .	" 87 " " 1008 "
Atrato-Tuyra . . .	" 115 " " 800 "
Atrato-Truando . .	" 125 " " 950 "
Atrato-Napipi . . .	" 180 " " 778 "

The committee reported to the President as follows:

WASHINGTON CITY, February 7th, 1876.

To the President of the United States :

The commission appointed by you to consider the subject of communication by canal between the waters of the Atlantic and Pacific Oceans across, over, or near the Isthmus connecting North and South America, have the honor, after a long, careful and minute study of the several surveys of the various routes across the continent, unanimously to report:

That the route, known as the "Nicaragua Route," beginning on the Atlantic side at or near Greytown, running by canal to the San Juan River; thence following its left bank to the mouth of the San Carlos River, at which point navigation of the San Jaun River begins, and by the aid of three short canals of the aggregate length of 3.5 miles reaches Lake Nicaragua; from thence across the lake and through the valleys of the Rio Del Medio and the Rio Grande to what is known as the port of Brito, on the Pacific Coast, possesses, both for the construction and maintenance of a canal, greater advantages, and offers fewer difficulties from engineering, commercial and economic points of view than any of the other routes shown to be practicable by surveys sufficiently in detail to enable a judgment to be formed of their relative merits, as will be briefly presented in the appended memorandum.

The data for the conclusions of the commission will be found in the reports of the various surveys and examinations made under the direction and auspices of the Navy Department; copies of which are transmitted herewith.

A statement relating to these surveys and examinations, with a brief account of the characteristic features of the routes, will be found in the accompanying memorandum prepared by the commission.

We have the honor to be, with high respect,

Your obedient servants,

ANDREW A. HUMPHRIES,
Brigadier-General, Chief of Engineers, U. S. A., etc.

C. P. PATTERSON,
Superintendent United States Coast Survey.

DANIEL AMMEN,
Commodore and Chief of Bureau of Navigation.

On April 15, 1879, Congress called upon the President for the report of the commission, and it was printed as a public document by the government.

In 1876-77 Mr. Menocal, while in the employ of the Nicaraguan Government surveying for harbor improvements at San Juan del Norte, made large additions to the knowledge of the topography of the lower San Juan.

On the 19th of April, the President appointed Rear Admiral Daniel Ammen and Civil Engineer A. G. Menocal, delegates on behalf of the United States Government to attend an International Congress appointed to convene at Paris May 15th, 1879, ostensibly to determine concerning the relative merits of the different canal schemes, but really, as was afterwards apparent, to select and approve the route at the Isthmus of Panama, for which Lieut. Napoleon Bonaparte-Wyse had the year previous obtained a concession from the Colombian Government. Just before the assembly of this Congress, an agent, representing French interests, failed by one vote only in the Senate of Nicaragua to secure the confirmation of a concession for a canal which he had just negotiated. Had a valid Nicaragua canal grant been available at this time in Paris, it would probably have influenced materially the decision arrived at there, in favor of Panama.

Admiral Ammen and Mr. Menocal were present at all the sittings of the Congress, and at the proper time ably presented the advantages of the Nicaraguan route. Action was, however, limited by the early adoption of a resolution, to the effect that the construction of a canal at a uniform level was possible; and it was reported by a commission, to which the question had been referred, that "the maritime canal which would above all offer such advantages, should be located between the Gulf of Limon and the Bay of Panama." The limitation of the canal to one of "uniform level," which it was claimed was possible at Panama, purposely excluded the Nicaragua route, where a canal could only be constructed with locks, and left no choice to the Congress.

Believing the Panama project to be impracticable, a Provisional Inter-oceanic Canal Society, consisting of Capt. S. L. Phelps, Gen. U. S. Grant,

Admiral Daniel Ammen, Gen. Geo. B. McClellan, Gen. Edward F. Beale, Hon. Levi P. Morton, Messrs. Geo. W. Riggs, Howard Potter, Hugh J. Jewett and others, obtained from the Republic of Nicaragua, in May, 1880, through the Society's representative, a concession for the construction of a canal. The contract was negotiated by Mr. Menocal, who, while awaiting the assembly of a special session of the Nicaragua Congress for its ratification, made a re-survey of the western division between the Lake and the Pacific Ocean, and also made some further examination of the eastern section of the canal line under orders from the United States Government. In December, 1881, a bill was introduced in the Senate of the United States, by Senator Miller of California, with the object of granting the aid of the United States to the construction of the canal, but it was hindered in its progress by opposing interests until the time allowed by the concession for the commencement of work lapsed. But before this occurred, Capt. Phelps, with the aid of Captain Lull, an officer of the Navy, had obtained from Nicaragua an extension of time until September 30th, 1884. The bill, which the Committee on Foreign Affairs had reported to the 47th Congress, was not acted upon, and a similar bill was brought before the following Congress by Mr. Rosecrans of California, and referred to the House Committee on Foreign Affairs, December 10th, 1883. Both bills were hindered in their progress by active and powerful opposition, both in committee and before Congress, from the friends of the Panama Canal and the Tehuantepec Ship Railway projects, who had little or nothing to hope for themselves, but were most zealous in their endeavors to prevent the friends of the Nicaragua route from obtaining the desirable assistance of the United States Government, which both bills provided for. M. de Lesseps and Captain Eads appeared, personally or by their representatives and friends, before different committees, apparently not so much to advocate their own projects as to oppose that of Captain Phelps and his associates. Action on the bill was continually deferred in one session after another, until at last towards the close of December, 1883, it came up as unfinished business. The vote in favor of taking it up for consideration was 127 ayes to 76 nays, but notwithstanding there was a large majority in favor of adopting the bill, immediate action could not be had, inasmuch as a two-thirds vote was a preliminary necessity, and no subsequent opportunity could be secured.

Before this time the Provisional Society had been merged into a corporation under the designation of the Maritime Canal Company of Nicaragua, and negotiations for capital were carried on, outside of the attempt to secure aid from Congress. The negotiations resulted in the formation of a syndicate of capitalists who, with the co-operation of Gen. U. S. Grant and Gen. Geo. B. McClellan, agreed to undertake the construction of the canal. The failure of the firm of Grant & Ward, however, prevented the business being carried to a conclusion, and before other arrangements could be made the concession lapsed.

It is not improper to say at this point, that during a considerable period of time prior to these events Mr. Blaine, while in office as Secretary of State, and his successor, Mr. Frelinghuysen, had been preparing the way for a more definite and positive interest on the part of the United States Government in a Nicaragua Canal. As a consequence, while there was a continuat

assertion to the world, of the desire on the part of the government for the construction of this work, its construction by private enterprise did not receive that support from Mr. Frelinghuysen, which otherwise it might have expected. As a matter of fact, he was actively engaged, even before the expiration of the Maritime Company's concession, in preparing the way for a treaty between the two governments with reference to the construction of the canal by the United States Government itself. The limit of time granted the Maritime Canal Company in which to commence work, expired September 30th, 1884, and Mr. Frelinghuysen made such progress with his negotiations that his treaty was concluded and submitted to the Senate in December of the same year. On December 15th, 1884, the Secretary of the Navy ordered Mr. A. G. Menocal, Civil Engineer, U. S. Navy, to proceed to Nicaragua to perform certain labors in connection with the treaty. In his letter of instruction, dated December 15th, the Secretary says: "A treaty has been lately concluded with Nicaragua, which gives to the United States the right to build a canal across the Isthmus within the territory of that Republic following the most available route from ocean to ocean."

On December 20th, Mr. Menocal, with several assistants, officers of the U. S. Navy, sailed from New York, arriving in Nicaragua early in January, 1885. Mr. Menocal's instructions directed his attention to the surveys already made, and particularly to any change in route which had been suggested as possibly available for shortening the line and diminishing the cost, and he was directed to make clear to the Nicaraguan Government the advantage to Nicaragua of the treaty.

The work of the expedition was strictly confined to a re-location of the Eastern section of the canal. The Western section was rectified by Mr. Menocal in his survey made under orders of the department in 1880. The expedition returned to New York June 3rd, 1885, and its report, a very valuable document, was completed and submitted by Mr. Menocal to the Secretary of the Navy in the following November.

As has already been stated, the treaty with Nicaragua was submitted to the Senate in December, 1884. Great secrecy as to its provisions was maintained, but journalistic enterprise secured in some way a copy of President Arthur's message, with which the treaty was transmitted, as well as of the treaty itself, and both were published entire in the *New York Tribune* of December 18th, 1884.*

Its most noteworthy conditions were as follows:

The canal was to be built by the United States, and to be owned jointly by the United States and Nicaragua. The United States was to protect perpetually the integrity of the territory of the Republic.

Privilege was given the United States to construct from ocean to ocean railway and telegraph lines joining the termini of the canal.

A tract of land two and one-half miles wide, of which the canal was the central line, and another two and one-half miles wide around the southern end of the lake, were conceded.

The canal was exempted from taxation.

*See full text of treaty in Appendix No. 5.

The United States was to have exclusive control of construction.

The net revenues were to be divided between the owners in the proportion of one-third to Nicaragua and two-thirds to the United States, and accounts were to be liquidated quarterly.

The United States was to loan Nicaragua \$4,000,000 for works of internal improvement, to be refunded out of Nicaragua's share of the revenues.

The treaty was signed by Fredererick T. Frelinghuysen, Secretary of State, on behalf of the United States, and Joaquin Zavala, Special Envoy, on behalf of the Republic of Nicaragua.

The treaty was before the Senate until January 29th, 1886, when it was considered in executive session; it failed of ratification, but only under the two-thirds rule. The vote upon it stood 32 ayes to 23 nays. A motion to reconsider was entered and the treaty remained before the Senate. On the 4th of March, 1885, President Cleveland took office. Early in his administration the treaty was withdrawn for further executive consideration, and was not again presented to Congress. January 29th, 1886, Mr. Menocal's report of the survey of 1885, with its accompanying drawings, was printed, but no further action was taken.

The friends of the enterprise, though unsuccessful in these attempts, were not disheartened. No sooner were they assured of the failure of the treaty than they began to seek new associates and to reorganize in order to take advantage of the favorable temper of the Nicaraguan Government, and of the intimate knowledge of the route which had been acquired by the recent surveys made under the auspices of our own government.

In April, 1886, it was determined to bring the matter again before the public. Commander H. C. Taylor, at that time on duty in New York, remembered the interest which had always been taken in the subject by the American Geographical Society, and the discussion before that body in 1879, of the inter-oceanic ship canal question. He sought the opportunity to present the subject to their attention anew, and through the kind offices of the President of the Society, Hon. Chas. P. Daly, was invited to do so.

Public attention was in this manner again called to the subject, a number of prominent individuals at once became actively interested and, on the 20th of October, 1886, met together by appointment to consider ways and means. This resulted in the organization of an association, which undertook to obtain a concession from Nicaragua, the payment of such guarantees as it was understood that Government would demand, the making of necessary surveys and examinations of the route, and the incorporation and organization of such companies as should be found necessary to carry forward the enterprise to its consummation.

Hon. Chas. P. Daly, Commander H. C. Taylor, Horace L. Hotchkiss, A. S. Crowninshield, Francis A. Stout, Frederick Billings, Hiram Hitchcock, A. B. Darling, J. W. Miller, James Roosevelt, R. A. Lancaster, Henry R. Hoyt, F. F. Thompson, G. H. Robinson, A. C. Cheney, H. Fairbanks, C. H. Stebbins, C. Ridgely Goodwin, A. B. Cornell, J. F. O'Shaughnessy, A. G.

Menocal, Admiral D. Ammen, Robert Garrett, T. Harrison Garrett, G. E. Kissell, Henry A. Parr, Chas. D. Fisher, John L. Williams, Jules Aldigé, and many other distinguished persons became members of an association which, at a meeting called for the purpose, was formally organized December 3d, 1886, by the adoption of Articles of Agreement and by the election as its first officers, of Mr. Francis A. Stout, President, Mr. J. W. Miller, Secretary, and Mr. Horace L. Hotchkiss, Treasurer.

On March 2nd following, the association dispatched Mr. A. G. Menocal to Nicaragua, with full authority to negotiate with the government. He arrived at Managua, the capital, on the 16th, and there met the representative of the Nicaraguan government, Dr. Adan Cardenas, with whom, on behalf of the association, he negotiated a concession which was ratified by the Nicaraguan government April 24th, 1887.* A provision was inserted requiring payment to the government, within sixty days, of one hundred thousand dollars, forfeitable in case of failure, and to be applied on account of police charges in case of success. The concession was duly secured to the association by compliance with this condition.

On the 30th of November, 1887, an engineering expedition was dispatched to Nicaragua in charge of Mr. R. E. Peary, Sub-Chief Engineer, for the purpose of making the final surveys and location of the canal. Mr. Menocal was constituted by the association Chief Engineer of the enterprise.

The party arrived at San Juan del Norte, December 9th, and commenced work at once, and was shortly afterward joined by the Chief Engineer. This corps re-inforced from time to time has been constantly employed until a recent date. It consisted of six land parties, one hydrographic party and two boring parties, numbering some forty-five engineers, rod and chain men, and one hundred laborers. They re-located the entire route of the canal and acquired the most minute information concerning its every physical feature, so as to permit an accurate estimate of the character and cost of the work in all its parts and in every detail. Although the length of artificial canal is less than thirty miles, the total length of lines actually surveyed by transit and level, in cross-sectioning, location of locks, dams, embankments, railroads, flowage lines, etc., etc., through a most difficult country, is not less than 4,000 miles.

In December, 1887, the 49th Congress assembled and on January 10th, 1888, Senator Edmunds introduced a bill in the Senate for the incorporation of the Maritime Canal Company of Nicaragua. A similar bill was introduced by Mr. Norwood in the House of Representatives. They were both referred to the usual committees, and reported back with amendments in February; that from the Senate Committee on the 9th, and that from the House Committee on the 16th. Each committee recommended the passage of its respective bill.

In the meantime the decision of the boundary question between Nicaragua and Costa Rica, which had been referred to President Cleveland for arbitration, made it apparent that a concession from Costa Rica, if not indispensable, was certainly desirable to assure certain rights to the company, and such a con-

*See Appendix No. 2.

cession was at once negotiated with that republic. It was ratified August 9th, 1888, and assured to the company all that it desired.*

The Senate bill was passed without delay, and being identical with that before the House, was permitted to take its place. Action upon it by the House was delayed, however, for one reason or another until February 7th, 1889, when it was passed by a vote of 178 yeas to 60 nays. There were eighty-four members not voting, of whom many probably a majority, were warm friends of the canal and had worked energetically for the passage of the bill. It was approved by the President and became a law February 20th, 1889, and named as incorporators, Messrs. Frederick Billings, Charles P. Daly, Daniel Ammen, Francis A. Stout, Horace L. Hotchkiss, Edward F. Beale, Hiram Hitchcock, C. Ridgely Goodwin, A. C. Cheney, J. F. O'Shaughnessy, H. C. Taylor, J. W. Miller, A. S. Crowninshield, A. G. Menocal, C. H. Stebbins, T. Harrison Garrett, Jules Aldigé, R. A. Lancaster, A. E. Mills, G. E. Kissell, H. Fairbanks, George H. Robinson, A. B. Darling, J. E. McDonald, James Roosevelt, Christian Devries, F. F. Thompson, Henry A. Parr, and their associates.† In the meantime, the Association had also caused to be incorporated as a necessary adjunct, a Construction Company, under whose direction the final surveys and the preliminary work were carried on. This company is now executing the work, having entered into a contract with The Maritime Canal Company, for that purpose. Its first President was Francis A. Stout, who was succeeded in office by A. C. Cheney. On March 5, 1890, Hon. Warner Miller was elected to, and accepted the presidency of the company, and it is under his direction that the work of the canal is now being prosecuted.

On May 4th, 1889, The Maritime Canal Company of Nicaragua was organized by the Association, as required by Article VIII of the Nicaraguan concession, and by virtue of the charter granted by the United States; and to this company both of the concessions were transferred. Hiram Hitchcock was elected president and continues in that office. On the 26th of May a construction party, consisting of forty-seven engineers and their assistants, were dispatched to Nicaragua with supplies and material; they arrived at San Juan del Norte June 8th, and at once commenced work.

Shortly afterward questions concerning the respective rights of Nicaragua and Costa Rica, consequent upon different views of the boundary question and the "Treaty of Limits," caused some delays, but everything was finally adjusted, with satisfaction to all parties, by the kindly offices of Mr. Mizner, Minister of the United States to Central America, under the instructions of Mr. Blaine, Secretary of State.

On the 21st of August, 1890, at the request of Mr. A. L. Blackman, who claimed to be the representative of some imaginary rights in Nicaragua, Mr. Richardson of Kansas offered a bill in the House of Representatives to repeal the charter of The Maritime Canal Company. This attack on the company was the occasion only of an affirmation of its rights. The bill was at once referred

*See Appendix No. 2.

†See Appendix No. 1.

to the Committee on Commerce. On the 30th of August the chairman presented the report of the committee, which was as follows:

"Having carefully examined into the condition and affairs of said company, for the purpose of determining whether any abuse of the powers and privileges conferred by the act of incorporation has been practiced, or whether any of its corporate duties and obligations have been disregarded, or whether in the exercise of its sovereign power Congress should say that the public good is to be subserved by a repeal of the charter, your committee conclude that the exercise at this time of the power invoked would be a great wrong. Such powers have never been exercised except for the gravest reasons, and your committee believe that Congress is not yet prepared to exercise its reserved powers of repeal when every reason exists why it should commend rather than criticise."

The committee then sets forth at length its reasons for the action recommended and concludes as follows:

"Your committee beg leave to express the opinion that it would be a gross breach of faith for the United States Government to permit in any way the embarrassment of the project by considering unfounded propositions from any source for the repeal of the company's charter. When completed, as we have no doubt it will be at the earliest possible date, it will prove of greater importance and benefit to the United States than any other similar work in our history. It will make the Atlantic and Pacific coasts substantially one and be of incalculable advantage in the development of the trade of California, Oregon and Washington."

On the 6th of November, 1890, Señors Don J. A. Roman and Don Maximilian Sonnenstern, commissioners appointed by the Nicaraguan government October 4th, 1890, to inspect the performance of work by the canal company, with reference to the question of compliance with Article XLVII of the concession, which required an expenditure during the first year of the work of two million dollars (\$2,000,000), reported, that from the official inauguration of the works on October 8th, 1889, until October 7, 1890, there had been an expenditure by the company of more than the two million dollars (\$2,000,000) required in the concession, and the commissioners presented to the government a detailed account of the expenditures, signed by themselves and by the representatives of the canal company. On the 10th of November Señor Don J. F. Medina, Minister of Public Works, advised the general agent of the company at Managua, Hon. Henry C. Hall, that the company had more than fulfilled its obligations as to expenditure upon the works, under the requirements of the concession.

On the 12th of December following, by the direction of His Excellency, the President of Nicaragua, the Hon. Horacio Guzmán, the Minister of Nicaragua to the United States, informed the company that Article XLVII of the concession had been "fully and completely complied with." Fulfillment of the requirements of this article satisfies the condition which entitles the company to a term of ten years during which to construct the canal.

On the 10th of January, 1891, a bill* was introduced in the Senate of the

*The full text of the bill appears in Senator Morgan's speech. See Appendix No. 7.

United States by Senator Sherman*, empowering the United States to guarantee the principal and interest at four per cent. per annum, of an issue of \$100,000,000 of canal company bonds to be issued for construction purposes. The President of the United States was empowered by the bill to name six of the directors of the company, and \$70,000,000 of the capital stock of the company was to be placed in the custody of the Secretary of the Treasury, as a pledge and security for the repayment to the United States of any amounts advanced in pursuance of the guarantee. The duty was to be conferred upon the Secretary of the Treasury, to vote upon the stock at his discretion, and an option was reserved to the United States to purchase the same at any time before the maturity of the bonds.

The introduction of the bill was not at the instance of the promoters of the canal enterprise. The measure originated with the Senate Committee, as stated by Mr. Morgan, one of its members, in his argument advocating its adoption. It was, in fact, a far-sighted measure of public policy, devised and matured by the experienced and public-spirited men who presented it, the members of the Senate Committee on Foreign Relations. It was reported late in the session, at a time when other questions of grave importance demanded immediate attention, it was also regarded by some with alarm or misgivings as involving, although remotely, the possibility of financial liability on the part of the government, and therefore not to be passed without careful consideration and discussion of all its provisions. The bill was strongly presented by Senator Morgan and ably supported by every member of the committee and by many other Senators, but owing to the pressure of other public business, which precluded the possibility of a sufficient discussion, Senator Sherman gave notice on the 27th of February that it would not be called up again for further consideration during the session.

Although the measure was not inspired or even suggested by the Canal Company, its Directors, recognizing the national character and importance of the enterprise, consented to accept its provisions and to forego the profits and advantages which they expected to realize from the prosecution of their enterprise as a commercial undertaking; non-action by the Senate, however, restored the former status, and steps were taken without delay for a presentation of the enterprise, now advanced to a demonstration of its feasibility, to the capitalists of the world.

On March 14th, 1890, Hon. Warner Miller, President of the Construction Company, undertook a personal inspection of the work. He sailed from New York for Nicaragua on the steamship Aguan with a company of gentlemen, among whom were H. F. Donaldson and H. F. Gooch, prominent English engineers, D. McN. Stauffer, an American engineer, Maj. C. E. Dutton, U. S. A., formerly of the United States Geological Survey, Lieut. Guy Howard, U. S. A., and several journalists. Commander Brownson, U. S. N., and Lieut. W. I. Chambers, U. S. N., joined the expedition upon its arrival at Nicaragua. The

*The views of Senator Sherman, chairman of the Senate Committee on Foreign Relations, and the speech of Senator John F. Morgan, member of same committee, in advocacy of the measure, will be found in Appendixes Nos. 6 and 7.

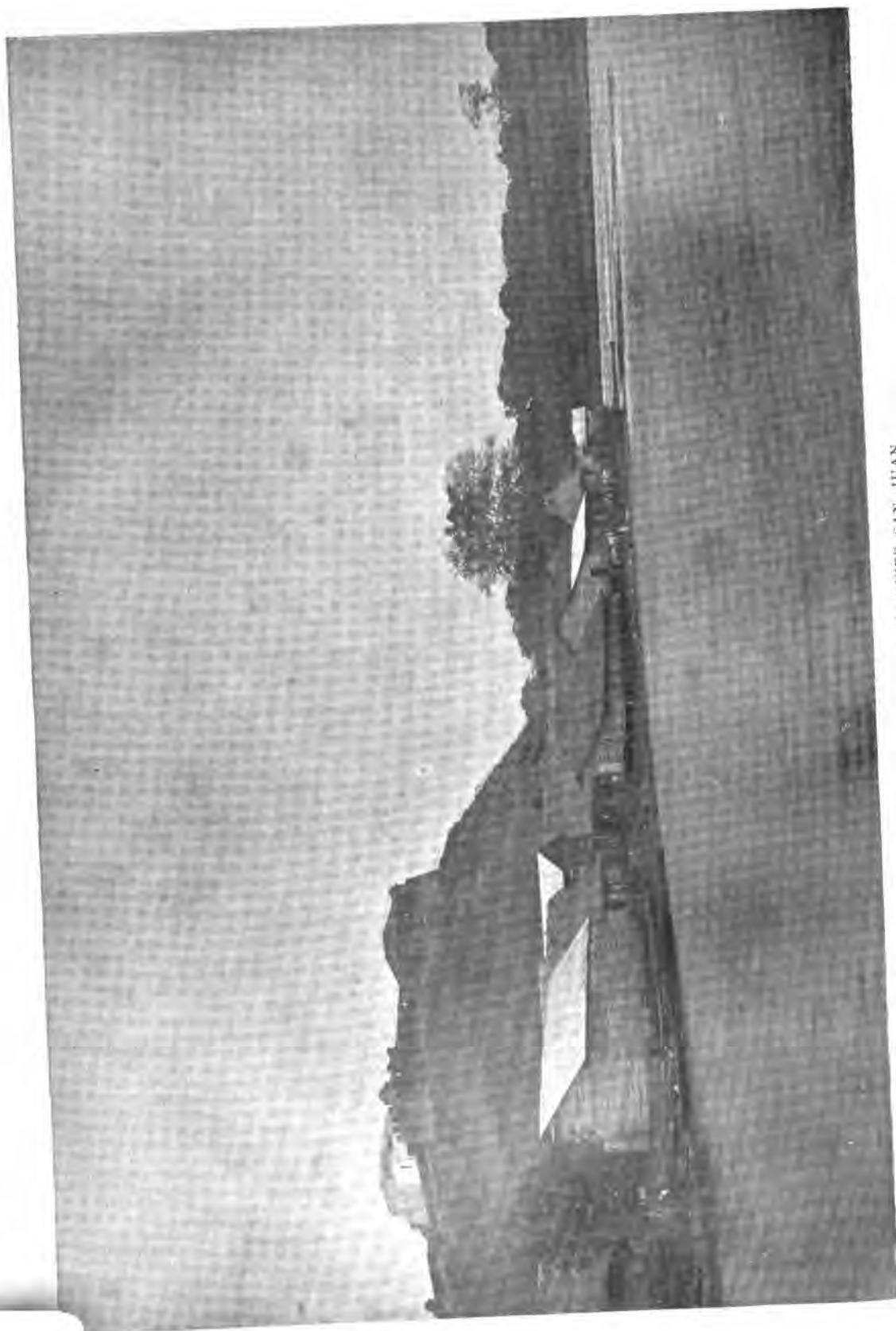
government officers accompanied the party in an official capacity and have made reports of their inspection to the Government.

On the 26th of March the Aguan was wrecked upon a coral reef in the Caribbean Sea, but the entire party escaped without loss of life, and after a stay of six days on the island were rescued and taken by the coasting steamer Carazo to San Juan del Norte, where they arrived safe and well on the 2nd of April.

The inspection of the canal throughout the entire route and including the terminal ports proceeded without further misadventure, and resulted in the eminent satisfaction of President Miller and the entire party. The engineers and government officers especially spoke with unqualified approval of all that had been done, and of what was proposed for the future. The English engineers, representatives of the contractors for the Manchester Ship Canal, said they had never known a large work so thoroughly studied and mastered in every detail, and moreover, that in its achievement no engineering difficulties were involved. The only question presented was one of magnitude. The inspection showed that in all the work done the cost had been materially less than the estimates, in some instances as much as fifty per cent. below them. The railroad built through the swamp back of San Juan del Norte and on towards the divide, for which \$60,000 per mile was allowed in the estimate, has actually cost but \$40,000 per mile. The ascertained cost of dredging, through the efficiency of the great machines brought from Colon, is found to be very materially less than the estimate.

President Miller returned from his inspection May 7th, and an extract from his report will be found in the Appendix.*

*See Appendix No. 10.



CASTILLO, LOOKING UP THE RIVER SAN JUAN.

CHAPTER II.

PHYSICAL DESCRIPTION OF COUNTRY TRAVERSED.

The political division known as the Republic of Nicaragua, one of the five States of Central America, lies between Honduras and Salvador on the north and Costa Rica on the south, extending from Cape Gracias á Dios to the mouth of the San Juan River on the Caribbean Sea, and from the Gulf of Fonseca to the Bay of Salinas on the Pacific Ocean, that is from latitude 10-degrees 90 minutes to 15 degrees north, and from longitude 83 degrees 20 minutes to 87 degrees 40 minutes west from Greenwich.

In shape, it is an irregular quadrilateral or trapezoid, of which the longest side extends across from the Gulf of Fonseca northeasterly to Cape Gracias á Dios 290 miles; from this cape along the Caribbean to the mouth of the San Juan is 250 miles, and thence along the Costa Rican boundary to the Bay of Salinas on the Pacific is 120 miles. The Pacific coast-line, from the Bay of Salinas northwesterly to the Gulf of Fonseca, is 185 miles in extent.

The State has an area of about 49,000 square miles and in point of size is first among the Central American Republics. Within its limits is found a population of about 400,000, of which about nine-tenths are of aboriginal origin, negroes or mixed races; the remainder are pure whites, mostly of Spanish descent. Its shores were first seen by Europeans when Columbus in 1593 rounded its northeasterly point, which he named Gracias á Dios, in thanksgiving to God for more favorable winds. He was probably the discoverer also of the harbor of San Juan del Norte, as he sailed southerly along the entire eastern coast. Nicaragua was visited and first explored by Gil Gonzales Davila in 1522. In 1524 it was subjected to the Spanish crown, and subsequently became a part of the Captain-Generalcy of Guatemala, which embraced the principal provinces or intendencies of Guatemala, Honduras, San Salvador, Nicaragua and Costa Rica. In 1821 these provinces threw off their allegiance to Spain and formed a confederacy, but this was dissolved in 1839, and since that date these States have existed as distinct Republics; occasional attempts at confederation have proved futile.

Excepting the Department of Segovia, which borders on and resembles the central portion of Honduras, Nicaragua has a topography and climate differing in marked degree from its neighbors.

Its mountain system can scarcely be considered as resolved into ranges, although it is frequently so spoken of. The Cordillera which traverses both continents has nowhere in Central America the character of a single clearly defined chain like the Pyrenees or the Appenines in Europe, or the Cascades and parts of the Andes in the Western continent. The crest of the Isthmian portion of the system is generally parallel to the Pacific shore; although it occasionally diverges from it, it is never more than about 75 miles distant from

the western coast, while in some portions of Nicaragua and Costa Rica it approaches to within six or seven miles of it. In southern Honduras and Nicaragua, instead of any appearance of a chain or range, there is found a wide extent of country of generally high elevation, from which occasional peaks rise still higher, attaining at times altitudes of 4,000 or 5,000 feet above the sea, but appearing less lofty than they really are because of the high platform from which they spring. This mountain mass extends from Honduras into Nicaragua in the department of Segovia, and thence southeasterly, subsiding gradually into low hills until its line is completely interrupted by the San Juan River on its course to the sea; it sweeps along the eastern shores of Lakes Managua and Nicaragua, throwing out spurs towards the Atlantic between which flow the streams which empty into the Caribbean. Its declivities, towards the shores of the lakes, are often abrupt but not precipitous; on the east they fall off in gentle undulations and wooded plains towards the Mosquito shore. South of the San Juan the hills gradually rise again into the lofty mountain masses of Costa Rica. This is the true Cordillera of the continent; the fact that its continuity is interrupted by the valley of the San Juan, which carries eastward to the Atlantic the waters which fall upon the western slopes is, so far as an inter-oceanic canal is concerned, a fortunate provision of nature. In some remote period of the past, there was opened a way for the discharge eastward of the waters of the lake, that otherwise would have found their way westward to the Pacific through a depression but a few feet higher. West of the lakes, along the whole Pacific coast, there is found a hilly region of some elevation commonly known as the Coast Range, but the hills are scarcely of sufficient height to entitle them to the dignity of recognition as a mountain chain. Across this ridge, which actually parts the waters flowing to the Atlantic and Pacific, there are several low and easy passes, of which that between the mouth of the Rio Lajas on Lake Nicaragua and Brito on the Pacific Ocean is the lowest that exists anywhere across the continental divide from the Arctic Ocean to the Straits of Magellan. It has an elevation of only 153 feet above the sea.

Between the Cordillera and the Coast range is found the great geographical feature of Nicaragua, a remarkable depression about 70 miles wide and nearly 100 miles long, its major axis parallel to the Pacific coast. Here are found the broad and beautiful Lakes of Nicaragua and Managua, and the fertile Plains of Leon and Conejo, elevated but a few feet above the lakes. In this depression, the bottom of which is below the sea level, are gathered the waters which flow from the mountains and plains on either hand, the surplus of which is discharged by a single outlet, the San Juan River, which, traversing a valley between low and densely wooded hills, flows through the break in the Cordillera and then through the lowlands of the coast into the Atlantic Ocean. The valley of this river, the inland waters of the great central plateau, and the low pass across the Coast Range, are nature's route for inter-oceanic communication.

Scattered throughout this central depression is found a remarkable series of isolated cones of volcanic origin, commencing with the low wooded islands of Solentiname and Chichicaste, which rise in the southeastern part of Lake Nicaragua, and terminating with the peak of Coseguina (4,000 feet high), in the

extreme northwest corner of the State. A group of these volcanic peaks, the principal of which are El Viejo (6,000 feet), Momotombo (7,000 feet, the highest point in the State) and Coseguina, already named, are crowded close together in the extreme northwest, between Lake Managua and the Gulf of Fonseca. Most or all of them are extinct, but several may still be regarded as active, though for the time being quiescent.

In the south-central part of the State, the Cordillera becomes a confused mass of peaks and ridges with scarcely any elevations exceeding 1,000 feet. The San Juan River valley, extending from the great lake to the Atlantic, between the mountains to the northward and the still loftier peaks of Costa Rica to the southward, together with the low altitude of the Coast Range, affords a natural pathway through which the northeast trades, blowing from the Caribbean Sea, sweep continually over the coast and valley region, changing, cooling and purifying its air, and modifying its temperature, to such a degree that early writers, carried away with the delights of its climate, spoke of it as the Paradise of Mahomet.

These winds blow with such continuity and regularity that, under their influence, the waters of the lake rise and fall regularly; this movement long since occasioned a popular but erroneous notion that the level of the lake responded to the movements of the ocean tides. The winds are strongest from noon until evening, and bank up the waters upon the southwestern shore in foaming breakers. They subside towards morning, and the waters recede and the equilibrium is restored. The regularity with which the trade winds blow, gives a corresponding regularity to the apparent rise and fall of the lake and the semblance of a tidal movement.

Lake Nicaragua, known also as the Lake of Granada, is the largest body of fresh water between Lake Michigan and Lake Titicaca. It is 110 miles long and 40 miles in width. According to recent soundings it has a depth at some points of 240 feet. In most parts its margins are shoal, but occasionally there is deep water close along shore. Its outlet, the River San Juan, draining a watershed of some 8,000 square miles, which has an average annual rainfall of at least 80 inches, is a stream of large volume and in its upper reaches without flats or shoals. It is 121 miles long, and from 100 to 400 yards broad, and in the upper half of its course has a depth of from ten to twenty feet, but is interrupted by several rapids which interfere with its navigation. These rapids are traversed at all times by the canoes or "bungos" of the natives, and during the rainy season all, except the Castillo Rapids, are passed by steamers of light draft with engines of moderate power. The steamer Victoria, now in use on the lake by the Navigation and Trading Company, and built at Wilmington, Delaware, in 1882, for that service, was "warped" up them during the high waters of the rainy season.

Near the centre of Lake Nicaragua is the twin island of Ometepe, its peaks, Ometepe and Madera, rising from the waters of the lake, with beautifully wooded slopes to heights respectively of 5,320 and 5,200 feet. The island is about eighteen miles long, and about six miles in width. On the slopes of these peaks and along the shores are coffee and cacao plantations, and the island has

a population of about 8,000 souls. Madera is covered with verdure to its top, and Ometepe about two-thirds of the way up. The beauty of these mountains, their wooded slopes rising from the bright transparent waters of the lake, and their summits lost in fleecy clouds, dominates the landscape and attracts the eye from every quarter. Other and smaller islands covered with verdure, add beauty to the scene. Along the shores of the lake vegetation stops abruptly before reaching the water's edge, and there appears a broad sandy beach, upon which the waves, driven by the trade winds, break in a heavy surf with the roll of the ocean. In the northern part of the lake, near Granada, is a group of little islands, called "Los Corales," said to number several hundred, remarkable for their picturesque beauty. To the northwest, about 15 miles distant and connected with Lake Nicaragua by the Estero Panaloya and the Rio Tipitapa, lies Lake Managua, another beautiful sheet of water 35 miles long and about 20 miles wide. Its level is about 134 feet above the sea or 24 feet above Lake Nicaragua. Upon the southwest are broad and fertile slopes and level plains covered with luxuriant verdure; to the north and east, miles away, and with a broad, gently sloping plain intervening, are the mountains of Matagalpa. In the Department of Segovia are loftier peaks, and when the sun is sinking behind the western hills, their summits are lighted up with a gorgeous glow and a magnificence of coloring unsurpassed in all the world.

The wide expanse of these beautiful lakes receives and temporarily impounds the rainfall of the surrounding watershed, the surplus gradually and regularly escaping through the "Desaguadero," (an ancient designation for the San Juan River, signifying a water outlet). This is nature's provision against any torrential rush of waters, such as is common to all other streams in tropical America. But for this fortunate provision a canal would probably be as impracticable by this route as elsewhere, for in the absence of the great storage basin which the lakes supply, the river would be as uncontrollable a torrent in times of flood, as the Chagres at Panama.

Between these lakes and the coast hills, in the rolling plains country, generally beautiful and fertile, are found the principal cities and nine-tenths of the entire population of the Republic. Rivas with a population of about 8,000, Granada with 15,000, Managua with 10,000, Leon with 35,000, Chinandega with 12,000, principal towns of the departments of the same names, and Masaya with 18,000 in the Department of Granada, are all west of the lakes. Matagalpa with 9,000 inhabitants in the Department of Matagalpa and La Libertad with 5,000 in the Department of Chontales are the most important places east of the lakes.

The broad expanse of country between the foot hills of the Cordillera and the Caribbean Sea, in Nicaragua and in Costa Rica also, is generally low and level; it is mostly covered with dense tropical growth, and is drained by several large rivers which are only navigable for a few miles near the ocean. This coast region already produces very remunerative crops of plantains, bananas and other tropical fruits; but not one per cent. of the soil adapted to culture has been appropriated. The entire district is also as well adapted to the growth of sugar, fibre plants, and rice as any region on earth. The rainfall is much greater

here than in the interior, the comparative coolness of the intervening country chilling and precipitating the excessive moisture from the clouds, before they leave the coast, and are carried by the prevailing winds over the lake basin.

The river Wanks, or Coco, or Segovia, for it is known by each of these names, rises in the mountains of the Department of Segovia and discharges into the Caribbean Sea at Point Gracias á Dios; it forms the boundary between Honduras and Nicaragua for a large part of its course. Farther south are the Grand, the Blewfields, and the San Juan in Nicaragua, and the Sucio, Reventazon and the Matina in Costa Rica.

Lying at a mean elevation of 2,000 or 3,000 feet above the sea, in the northern part of the Republic, the uplands of Chontales, Matagalpa and Segovia, enjoy a mild climate well suited to the cultivation of maize and other products of the temperate zones, and to grazing. There are said to be half a million head of cattle on the ranches north and east of the lake.

The metalliferous porphyries of the Cordillera abound in gold and silver-bearing quartz, especially in Chontales and the uplands of northwestern Segovia. The Chontales gold mines have been intermittently worked for many years. The mining industry is centred chiefly about La Libertad, the capital of Chontales, and Santo Domingo in Matagalpa. There are recent reports of the discovery of very rich placer mines between Segovia and Martis creeks—branches of the Prinza-pulka River which empties into the Caribbean Sea 110 miles north of San Juan del Norte.

The extensive primeval forests of the San Juan and the central departments abound in mahogany, cedar, rosewood, ironwood, pine, caoutchouc, gum copal, vanilla, sarsaparilla, logwood, and many other dyewoods, medicinal plants and valuable timbers.

The western provinces are chiefly agricultural, but there is also much valuable timber. The fertility of the soil is remarkable; it yields where cultivated, enormous crops of sugar, cotton, tobacco, cacao, coffee, rice and maize. Plantains, which furnish one of the staples of food to the lower classes, are also extensively cultivated. The opening of an inter-oceanic canal will not only provide convenient access to these slightly developed regions, but will also bring to Nicaragua an increase of population which will make its home markets for the more perishable commodities, a source of incalculable prosperity to the country at large. As has already been remarked, the principal cities are located in the western departments.

Leon, on the railroad which connects Momotombo at the northwestern corner of Lake Managua and Corinto on the Pacific, is the most interesting and by far the largest city of Nicaragua. From the roof of its cathedral one may see the Pacific Ocean, and from the top of one of its towers the waters of Lake Nicaragua. The cathedral is a grand old building, probably the largest religious edifice south of the city of Mexico. Its construction was commenced in 1706 and completed in 1743, and is said to have cost between four and five millions of dollars. It covers an entire square, and its front occupies the width of the Grand Plaza. It is constructed of cut stone, and is one firm

mass of masonry. During the civil wars it was several times converted into a fortress. Its roof is composed of massive arches, and in 1823 not less than thirty pieces of artillery were planted upon it. For more than a century and a half it has stood the vicissitudes of earthquake, weather, war, piracy and revolution, and its walls are still solid and unshaken.

Managua, the seat of government, admirably situated on a slight bluff on the western shore of the lake of the same name, near its southern extremity, though smaller than either Granada or Leon, is in many respects the most enterprising and most thriving city of the Republic.

The country immediately around Managua is as rich and fertile as any portion of the State, but between it and Masaya, which is about twelve leagues distant, occurs what is known by the natives as the *mal pais* or bad lands, an immense field of lava on the slope of the volcano of Masaya, which at its last eruption flowed down from the mountain towards the lake. This eruption is said to have occurred more than two centuries ago. Everywhere the fields are utilized up to the lava beds either for cultivation or grazing.

Granada, on the western shore and near the head of Lake Nicaragua, is another important city. It may be considered the commercial centre of the State, and for that reason probably more foreigners settle there than in the other cities. It is connected with Managua by a narrow gauge railway thirty miles long, the running time of which between the two cities is two and one-half hours. This is the oldest known settlement in Nicaragua. It was founded by Fernandez de Cordoba in the year 1522, on the site of an ancient Indian town, the capital of the Cacique Nicarao, a native prince, who received there hospitably the discoverers and subsequent conquerers of his country.

In the early days of Spanish domination there was held in Granada an annual fair, at which the merchandise of Spain was exchanged for the products of the country. Credible documents show that the business of the fair amounted to more than \$1,000,000 annually, a sum which represented a much greater value then than at the present time, but its wealth tempted attack, and it was several times plundered by bucaners and other freebooters and its prosperity destroyed. It was wantonly burned by the filibuster Walker when he was driven out by the Central American forces in 1855, but since then it has been gradually recovering. Its location on the lake, and with reference to the surrounding country, give it commercial advantages, from which it cannot fail to reap renewed prosperity, in any general industrial development. At the head of Lake Nicaragua, it must become, when the inter-oceanic canal is completed, the natural market for the coffee and other products grown in the adjacent country. Around it, and beyond Masaya and in the direction of Managua, are located the largest coffee *haciendas*.

Rivas, another important town in the department of the same name, about five miles north of the line marked for the route of the canal between Lake Nicaragua and the Pacific Ocean, is about three and one-half miles distant from San Jorge, its port on the lake, and is connected with that place by an excellent macadamized road and a horse railroad, recently completed. It is situated in a rolling and fertile country noted throughout the State for its rural beauty and

fertility. Within two leagues around it there is a larger rural population than is found within the same area in any other portion of the State.

The waters of the San Juan River, the outlet of the lakes, reach the ocean by several channels. Forty years ago a larger part was discharged at San Juan del Norte than now, but at the present time nine-tenths of its waters are discharged through the Colorado mouth or branch about fifteen miles to the south. As the canal utilizes for its course, the channel of the river above Ochoa only, there is an actual advantage in this deviation, inasmuch as it will facilitate the maintenance of the harbor, by preventing the deposit there of large quantities of alluvium with which the waters of the river are charged, and which are now carried into the ocean by the Colorado. As the San Juan, from a point three miles below Castillo, constitutes the boundary line between the sister Republics of Nicaragua and Costa Rica, the section of the canal, which utilizes that part of the river above Ochoa, will also border on the territory of Costa Rica up to the point indicated; and as that Republic has rights of navigation upon the river, the canal there will afford commercial facilities of great importance to her and of mutual advantage. The products, climate and general characteristics of Costa Rica are in many respects the same as those of Nicaragua. The general altitude of the interior is, however, more elevated.

The country through which the course of the canal is laid, for the first ten miles from the coast, is a flat alluvial formation, the accumulation of centuries, with occasional lagoons and swamps covered with zacate and with silico palms, or the primeval forests and a dense tangled, almost impenetrable, mass of underbrush and vines. From this point, its course is through wooded and fertile valleys between low hills to the divide cut, and thence to a connection at Ochoa with the San Juan; above Ochoa it receives the waters of the San Carlos coming from the mountains of Costa Rica. This affluent must in course of time become a valuable route of water communication with the State in which it takes its rise, opening up as it will a section of country of exceptional fertility, accessible at present only by boats of little size and draft, or over mountain roads which are almost impracticable during a portion of each year. From the mouth of the San Carlos the course of the San Juan—then and thereafter the route of the canal—is through what may be termed the highlands of the river, the abutting flanks of the Cordillera. Sixteen miles above the San Carlos occur the Machuca Rapids, five and six miles farther on Balas, six miles beyond are Castillo Rapids, the most important of all, and nine miles farther the Toro Rapids;—beyond which to the lake, the course of the river is through a broad valley of low lands bounded by more remote hills. Above the San Carlos and at Machuca the forests which clothe the banks of the river are tropical in luxuriance. The lofty trees are draped with vines which creep and twine among their branches and droop to the water's edge in massive walls of verdure.

Above Machuca there are occasional clearings—where the lands are cultivated or grazed—through which the distant hills appear; at other places the hills themselves rise with steep and almost precipitous slopes directly from the river. Squier likens this part of the river to the Highlands of the Hudson.

At Castillo is an old Spanish fort, garrisoned by the Nicaraguan Gov-

ernment. It was considered impregnable by its builders, but was captured by a British force in 1780. Post Captain (afterwards Admiral) Nelson was in command of the Naval Corps of the expedition.

The erection of a dam at Ochoa and the execution of other works of canalization will of course change many of the present aspects of the river, deepening its waters over the rapids and in numerous places expanding them into broad and lake-like surfaces, adding to its advantages for navigation and to its beauties as part of an already delightful landscape. One important peculiarity of the San Juan, already adverted to, should be particularly noted. It is entirely exempt from the floods common to all other tropical streams. This is owing to the fact that the great lakes serve as receiving reservoirs, on the broad expanses of which the rainfall is stored and from which it is delivered slowly instead of being concentrated from the adjacent hillsides into narrow valleys, and thus massed into rushing, torrential floods.

The harbors of Nicaragua, are San Juan del Norte (popularly known as Greytown), on the Atlantic, and the Bay of Salinas, Port of Corinto, and Gulf of Fonseca, on the Pacific. More than a quarter of a century ago the harbor of San Juan del Norte; which before that time was easy of access, well protected and the principal port of Central America, with a depth of 24 feet of water in both channel and harbor; was closed entirely by a sandbar which formed across its entrance, and for years it was merely a fresh water lagoon, accessible only by lighters through a narrow and difficult entrance two and a half miles to the eastward. The closing of the original entrance occasioned a gradual partial filling of the old harbor with silt. The erection of a breakwater, extending already a thousand feet into the ocean and to be extended farther, has resulted, as Mr. Menocal anticipated, in the reopening of the old entrance; and the channel thus formed has been deepened to about fifteen feet at the present time. The effect of the breakwater and the action of the drifting sand, has thus far been very satisfactory to the company, and to the engineers who have inspected the work, and indicates the ultimate and thorough success of the plans adopted for the restoration of the channel and harbor, and its perfect adaptation to the needs of commerce and as the eastern terminus of the canal.

Brito has been designated as the western terminus and port of the canal upon the Pacific, not because of any present excellence, but because of its availability, as the point at which the lowest pass across the Isthmus *debouches* on the ocean, and on account of its perfect adaptability to the needs of the work. It is situated at the mouth of the Rio Grande, the valley of which stream is utilized for the canal after it leaves the valley of the Rio Lajas and passes the western divide. This valley, which opens out broadly towards the ocean, apparently once formed a considerable bay extending back more than a mile from the coast line, which in course of time has been filled up by river deposits. It is proposed to erect proper and necessary breakwaters and to re-open, by dredging—so far as it may be found requisite—what has once been, and may easily be made again, a good harbor.

The geology of Nicaragua and Costa Rica has not been thoroughly studied

except along the line of the canal. Of the region generally, a few facts relevant to its geological characteristics are here given:

First. The Atlantic coast region of Nicaragua and Costa Rica, extending inland towards the lake, consists generally of low, alluvial, wooded plains, but here and there occur ridges and hills of considerable elevation. It has many swamps and lagoons, and traversing the low lands is the delta of the San Juan River. Then comes a region of greater elevation, undulated by the demolished cones of long extinct volcanoes, now evidenced only by ridges and low wooded hills, the highest of which attain an altitude of perhaps a thousand feet. Farther inland the hills are of greater magnitude and elevation, finally merging into the main Cordillera. Along the line of the upper San Juan are found volcanic remains belonging to a past geologic age, but no recent volcanos or lavas exist anywhere in the vicinity. All volcanic action there has been wholly extinct during the present geologic age, and the lavas at the surface have been decomposed into clay; the rock that remains showing only in the stream beds.

Second. Between the west shore of Lake Nicaragua and the Pacific, the rocks, generally of volcanic origin, are all buried deeply in the product of their own decay; their covering, which consists of clay, loam and sand, has a depth ranging from ten to fifty feet or even more. These buried lavas were the product of intense volcanic action in periods very remote, and covered everything save here and there an outcrop of older limestone or other sedimentary rocks. They are uncovered only in the beds of the streams, along the ocean and lake shores, and occasionally they appear as perpendicular escarpments of a hundred feet or more. The volcanos which furnished these lava flows are not only extinct, but their craters have been destroyed, their cones demolished, and their location even is unknown. Some of them have left eminences, varying from mere knolls of ten feet to hills hundreds of feet in height, which disclose no evidence of volcanic origin, except to the geologist.

Third. To the northwest of the lake is a region resembling in many of its characteristics that last described, except that the hills are less numerous though more lofty and extensive plains of but slight elevation occur. There is more limestone and less evidence of volcanism, though nearly all the hills and ridges are built of igneous rocks. Here, also, excellent hydraulic lime is found in abundance.

Fourth. In the northern part of Chontales, Matagalpa and Segovia is a district of greater general elevation than exists elsewhere in Nicaragua. There is an extensive mountain system, rich in minerals and disclosing no evidence of volcanic action, recent or remote. The rocks studied and classified are similar to those usually found in mineral bearing regions—granite, porphyry, and others of igneous origin; also extensive stratified masses with numerous faults and displacements.

Fifth. Stretching from Coseguina, on the south shore of the Bay of Fonseca, to Ometepe, a mountain rising in Lake Nicaragua—a distance of about 160 miles—is found running parallel with the Pacific and generally at a distance of about 20 miles, a chain of isolated volcanic peaks, a few of which have shown signs of activity during the history of Nicaragua. Of these are the

following: Ometepe, with its twin peak Madera, forming an island in the lake, is distant some 21 miles from the nearest canal lock. Masaya, 55 miles distant, Momotombo, 80 miles distant, Santa Clara, 20 miles farther on, and, lastly, Coseguina, about 160 miles from the La Flor locks. All the other cones—including Madera in the lake—are entirely extinct, or have been dormant since the Spanish Conquest. The nearest of the Costa Rican volcanoes is not less than 40 miles away from the canal.

Our knowledge of the earth structure of the region traversed by the canal, although not extensive, is fortunately ample as regards the number, distribution and magnitude of its volcanic peaks, and is sufficient to permit the formation of intelligent conclusions regarding their influence upon the general question of the practicability of this route for the inter-oceanic canal.

No one will assert or even suggest that a volcanic eruption could have any effect whatever upon this question, unless the lava flows and other ejecta should fall into the canal. As the nearest vent, and this one now dormant, is situated 13 1-2 miles from the nearest shore of Lake Nicaragua, and as the lake or canal must be filled with lava before navigation could be impeded, and as there is no other volcano within thirty miles of the canal, the liability of damage to it from volcanic action may be dismissed as too remote for consideration. It is, however, conceded that earthquakes are of more frequent occurrence in districts containing volcanoes than in regions remote from them, and as such movements of the earth sometimes shatter and even overthrow structures built upon it, it becomes necessary, treating earth tremors as concomitant with, if not the result of volcanic action, to consider the volcanic phenomena of Costa Rica and Nicaragua, and as these natural manifestations are far more active in the country first named they have earliest attention.

The vents nearest to the eastern division of the canal location are found in that portion of the main Cordillera that traverses the country to the eastward of the lake, and is interrupted by the valley of the San Juan River. The nearest of this group is Poás, 40 miles due south of the junction of the San Carlos with the main stream; the next, Irazú, the most forcible and active of all, is 58 miles distant from the same locality. Turialba, 6 miles to the eastward of Irazú, is about the same distance away. These three are the principal peaks in the group. The northwestern group, which is separated from the other by the valley of streams flowing to the Atlantic, comprises Orosi, La Vieja, Miravalles and Tenorio. The first named, about 38 miles southeast of Rivas and the La Flor locks, is the most important of the number. La Vieja is 13 miles farther to the southeast, Miravalles 12 miles beyond, and Tenorio 65 miles distant. Although some of these occasionally show signs of commotion none can be considered as active. Orosi, the nearest on this side to the canal, has not given any sign within the memory of the oldest man living in its vicinity, nor does it have any appearance of an eruptive cone. It is not known to have a vent, and though it is reported to have been in action, there is no evidence that warrants the assertion.

The principal centre of volcanic or seismic disturbance of Costa Rica is the eastern group, and at San José quakes have frequently occurred. The city of

Cartago, at the foot of Irazú was greatly injured in 1841, and in 1888, during eruptions of Poás and Irazú, the ground in their immediate vicinity was somewhat shaken, but it does not appear that their activity has ever occasioned any disturbance outside of their immediate neighborhood, nor produced any other effect than slight tremors as far away as the Nicaraguan border. Castillo Viejo, the Spanish fort on the San Juan built as early as 1675, having high parapets and a central tower 60 feet in height, stands entirely intact, without a crack in its walls, and is as solid and substantial as if built yesterday.

Of the Nicaraguan volcanoes, Ometepe has already been referred to. It shows no sign of action at present, but erupted in 1883. The next is Mombacho, overlooking the City of Granada. It shows lava on its slopes some centuries old, but there is no record or tradition of any eruption. This peak, however, seems to be the centre of a region throughout which quakes and tremors are of not infrequent occurrence. In 1890 Granada was quite severely shaken, but without injury to its most substantial buildings, and the ruinous walls of an old church, destroyed by Walker's filibusters 40 years ago, were not thrown down. At Rivas, which is between Granada and the canal and about 38 miles distant from the former, the shock was felt only as a slight tremor. Mombacho is upwards of 40 miles from the canal, and nearly 50 from the locks at La Flor. About two centuries ago there was a volcanic eruption at Masaya, some 17 miles beyond Granada. From accounts preserved we learn the eruption was attended with very little violence, though the mass ejected was large and came from an orifice of low elevation, which has since given no sign.

Momotombo at the northern end of Lake Managua, Santa Clara, El Viejo and the rest of the chain beyond, are too remote (100 to 125 miles) to deserve more than a passing notice. The same may be said of Coseguina, on the shore of the Bay of Fonseca, which in 1835 was, it is true, the centre of the most violent outburst ever known in Central America, but this peak is 160 miles from the canal. With the exception of this eruption, seismic disturbances in Nicaragua have been of moderate energy, disturbing but a small area and to a slight degree. Such, concisely stated, are the facts concerning volcanic and seismic action in the country traversed by the Nicaraguan Canal.

For the most recent and by far the most valuable contribution to our knowledge of the orographic features of the neighborhood of Lake Nicaragua, and especially for an able discussion of the influence of seismic action upon the canal and its masonry constructions, we are indebted to Major C. E. Dutton, U. S. Army, formerly connected with the Geological Survey of the United States, and who is well known to the scientific world through his published writings on volcanic geology. This officer spent several weeks in Nicaragua in 1891, in critical investigation of the volcanic and seismic phenomena. He is the only geologist of note known recently to have visited this interesting region, and the only one who has given special attention to the question of risk to the canal by reason of its proximity to volcanoes. He possesses rare qualifications for this study, and his opinions are therefore entitled to great weight.

In the preparation of this sketch of the physical aspects of the region, recourse has been had to the paper referred to and also to the published writings

of other travellers and explorers who have visited the country or described its features. The full text of Major Dutton's discussion will be found in Appendix.*

As regards the phenomena itself, the manner in which seismic waves are propagated, the varying effects produced upon the earth surface by forces of equal intensity, acting from different depths, the conclusions deducible from surface indications as to the remoteness from the surface of the seat of disturbance, and as to the energy of the force itself, the reader is referred to the Major's able paper for a clear and graphic exposition of the most recent scientific thought. To summarize his remarks would be but to copy in large measure the text itself.

Other conclusions, not stated by the Major, seem deducible from the facts, and in strict agreement with his reasoning, namely; that the general features of seismic disturbances in Central America indicate very shallow *centra* and proportionately limited areas of destructive force; also that the seat of disturbance in all cases of quakes there observed, seems to have been in close proximity to active craters, or directly beneath them, and that volcanic activity—in some degree—occurred simultaneously with the quakes.

It would also seem inferable from the observed data that the concentration of energy and manifestation of it within restricted areas, as has always been the case in the portion of Central America in question, are influenced by the proximity of the active vents, through which escapes the force that would otherwise be stored up—to find expression later in shocks of greater violence and throughout wider areas. The permanent integrity of the fortress of Castillo Viejo already cited, and the solidity of all well constructed stone buildings in Rivas, which is near the canal line, and the immunity from injury enjoyed by Managua, Granada and Leon, which are nearer centres of volcanic activity, all point to the soundness of this reasoning.

Major Dutton also responds to a suggestion for an expression of his views concerning the effect of earthquakes upon superstructures and substructures of different kinds. The reader is referred to the paper itself for the full discussion. One important paragraph, however, is quoted.

"Only in the most formidable earthquakes are foundations liable to suffer, except perhaps incidentally, and secondarily from abnormal strains thrown upon them by the rocking of the superstructures."

The significance of this remark is obvious when the character of the canal constructions is considered, for not only are they all so remote from earthquake centres, as to be entirely beyond the radius in which destructive force has been known to act in the past, but they are of a nature which experience has shown will effectually resist such force, unless of extraordinary power. The locks are all sub-structures sunk deep in the earth and built upon solid foundations with no superstructures to support, the oscillations of which might disrupt their foundations. The dams and embankments have bases many times as wide as their height, and are incapable of oscillation.

If the remote contingency of damage to the canal accessories by earthquakes

*See Appendix No. 9.

be held as forbidding the undertaking, then the same argument should be consistently applied to all other industrial works and instrumentalities. The logical application of this reasoning would require that one-fourth of the area of the globe should remain a wilderness. Charleston and Lisbon should not have been rebuilt, and San Francisco should be abandoned.

The risk of injury to Nicaragua Canal constructions by earthquakes, only exists in the theories of those who are interested in the making of a canal at some other locality, or in the mind of the man who is naturally a pessimist and opposed to all bold undertakings.

CHAPTER III.

CLIMATE.

It has already been stated that the climate of Nicaragua is modified by its topography; it may be added that it owes its salubrity, which is notable, to the fact that the country lies entirely within the zone of the trade winds, the southern limit of which is approximately 10 degrees north. There is a general impression that the whole American Isthmus is very unhealthy; whatever may be the fact as regards some portions of the territory, it is in no respect correct as to Nicaragua. The experience of the different exploring expeditions, and of the surveying and working parties of the Nicaragua Canal Construction Company, show an exceptional condition of good health under unusual conditions of exposure and hardship.

The seasons are divided into dry and wet, and in the interior and on the western coast are of nearly equal duration, the wet season beginning about the first of November. From November to May it is almost rainless, but there are occasional showers, as during the rainy seasons there are many clear days.

There is, however, a marked difference between the humidity of the Atlantic coast and that of the interior valley and the west coast. On the Atlantic side there are two wet and two comparatively dry seasons. During the months of February, March and April and during part of August, all of September and part of October, the rainfall does not generally exceed that usual in the United States during the same months; but during the rest of the year the daily average at San Juan del Norte is nearly 1 1-2 inches; but this comes generally at night, and the day, until three o'clock, is usually pleasant. The total precipitation observed during the past year was 297 inches, distributed—236 inches during the wet season and 61 inches during the remainder of the year—but this excessive precipitation is only found immediately along the coast. The heavier rainfall on the coast is attributable to the fact that the trade winds, which blow almost continuously, sweeping for hundreds of miles over the Caribbean Sea, come to the coast laden with moisture, the surplusage of which is condensed by the cooler air of the higher Atlantic slopes of the Cordillera and precipitated. The atmosphere, thus discharged of much of its humidity, has less to distribute over the central valley and the west coast, and the rains there are correspondingly less heavy and less frequent.

The "trades" blow almost continuously up the river valley, and although the temperature rises to 95° at mid-day, it is still comfortable in the shade, and the nights are cool and pleasant. This is more marked on the lake, and in the country between the lake and the Pacific. The trade winds, blowing continuously, dissipate everywhere all miasma and exhalations, such as have proved so pernicious in that part of the Isthmus, which lies a few degrees farther south within the belt of tropical calms, they also lower the temperature of the whole



ENGINEERING PARTY'S CAMP.

country and give to it an exceptional equability. At Rivas the maximum temperature recorded during a term of years was 95° Fahr., the minimum 65°, while the greatest variation in any one year was 26.5° and the least 16.2°. At Granada, as determined by observations recorded at the National Institute in that city, the variations are about 2° less. The temperature records of the Canal Company cover the past year and a portion of the present. At San Juan del Norte from the 1st of June to the 1st of November, 1890 the maximum was 89.5°, the minimum 71°, showing an extreme range during that time of only 18°. In general terms it may be said that the temperature in the shade rarely rises above 90° and rarely falls below 70°; the ordinary variation is thus about 20° only, while the extreme variation does not exceed 26° or 27° during the entire year.

No better proof of the healthfulness of the country can be asked than the practical experience of the men who have been employed in surveys of the route and on actual work of construction thus far accomplished. The surveys were made through dense forests and jungle, where every foot of advance was gained by the use of the axe or *machete*, and through swamps and streams where the men were often compelled to do their work up to their waists in water.

The report of the surveying party of 1885, under Mr. A. G. Menocal, published by the United States Government, says: "During the four months we remained in the country, of which more than three months were of constant, arduous work, exposure and privation, no officer of the party was ever affected by sickness due to climatic causes; and as for the natives attached to the party, their only ailments were due to bruises caused by want of protection for their feet or limbs. It may be proper to add that our work was confined to the uninhabited, and what is generally regarded as the most unhealthy portion of the country."

In December, 1887, the engineering expedition under the charge of Mr. Peary, consisting of some forty-five surveyors, including their assistants, and accompanied by about one hundred negroes from Jamaica, landed at Greytown and commenced work. Peary says that, excepting the negroes, "only five members of the expedition had ever been in tropical climates before, and the rodmen and chainmen of the party were young men just out of college, who had never done a day's work nor slept on the ground a night in their lives. The rainy season prevailed more than a month beyond the usual period, during which time and for months afterward, all the members of the party, engineers and laborers alike, were equally exposed in their tents and in the forests, working sometimes on land, sometimes in the streams and swamps, to all the vicissitudes of the climate."

The only precaution observed was that the day's work was preceded by a cup of strong coffee and, when the work was concluded, it was followed by a bath and change of wet clothing for dry. After the evening meal, the men lay down in their dry clothing and slept, on the ground when on the march, or in their tents or thatched huts, on cots or cane beds when they were in camp, and this mode of life was endured day after day for months by them and by their

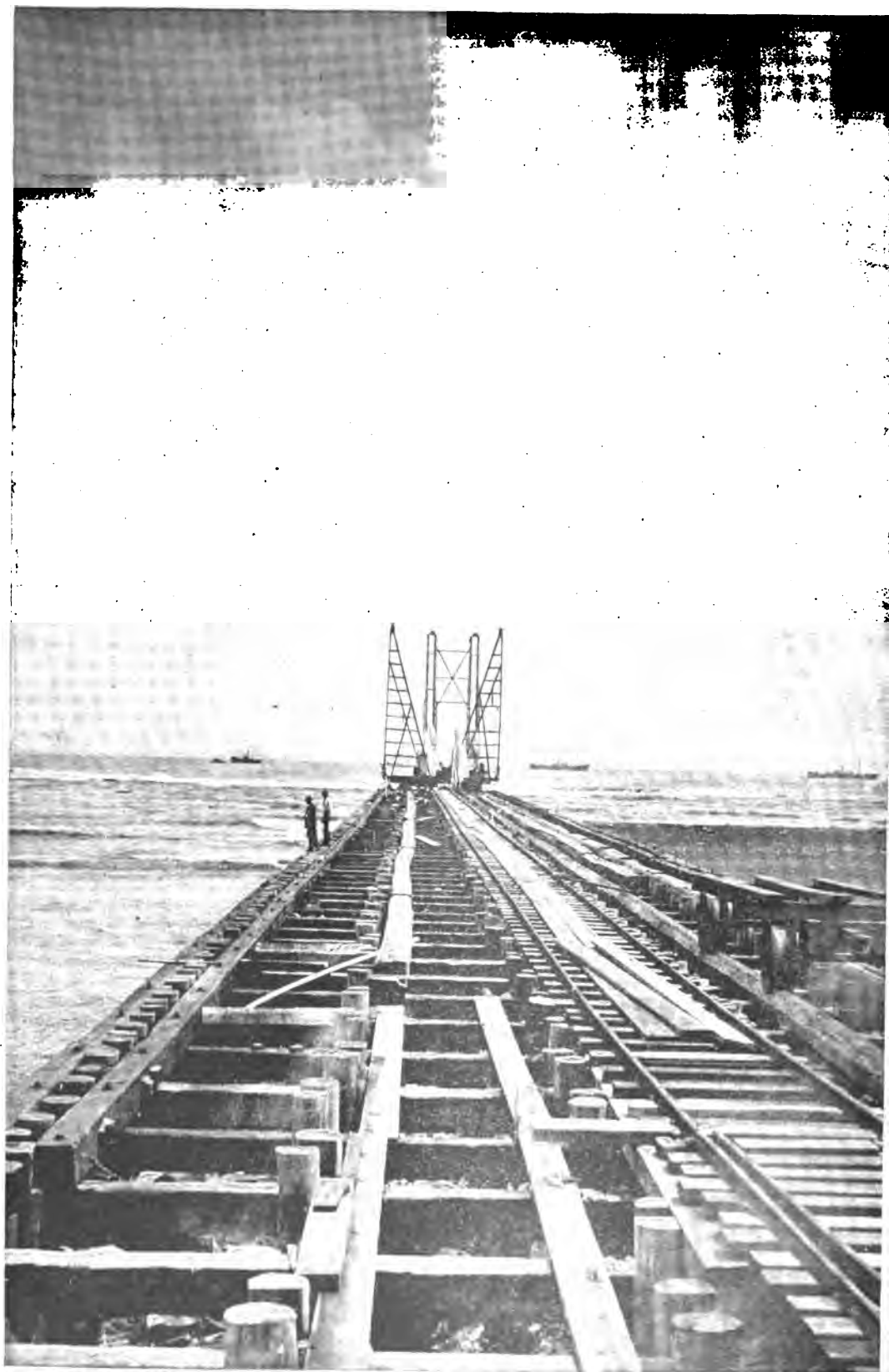
successors Yet, notwithstanding all this exposure, not only were there no deaths on the expedition, but there was not a single case of serious illness, and those who, at the expiration of their contract, returned to the United States, came back in better health and weight than when they went away. Of course, the men were well fed and sanitary rules were strictly enforced, but the results proved the natural salubrity of the climate.

Previous experiences are fully corroborated by recent reports of the surgeon-in-chief of the Canal Construction Company, Dr. J. Edward Stubbart. His annual report to the President of the company for the year 1890 is printed in full in the Appendix.*

It will be seen that Dr. Stubbart gives the total number of deaths occurring among employees of the company during the fourteen months as 23; of these, 5 were due to accident, 6 to disease contracted before entering the service of the company and only 12 were the result of diseases contracted while in the employ of the company, or which could in any sense be considered as climatic. The only deaths among the officers, who are mostly from the United States, were accidental. There are very few cities in the temperate zones that can show so good a sanitary record, and none can show better. The death rate in the chief hospital of the company for the past year was 1 17-100 per cent. In the New York Presbyterian Hospital, it was 10 73-100 per cent.; in the Roosevelt Hospital, New York, it was 9 76-100 per cent., and in the Orange Memorial Hospital it was 7 88-100 per cent.

*See Appendix No. 11.





THE BREAKWATER, SAN JUAN DEL NORTE.

CHAPTER IV.

THE PROPOSED CANAL.—THE ROUTE AND DESCRIPTION OF THE WORK.

San Juan del Norte, or Greytown, on the Atlantic and Brito on the Pacific are the termini; the distance from port to port is 169 1-2 miles, of which 26 3-4 will be excavated channel and 142 2-3 miles in lakes, rivers and basins. The summit is necessarily Lake Nicaragua, 110 feet above the sea. There will be three locks near either end; the summit level, maintained as shall be afterwards explained, reaching to within 12 3-4 miles of the Atlantic and extending to within 3 1-2 miles of the Pacific. This summit reach will therefore be 153 1-4 miles long.

For purposes of description, the route has been divided into four divisions, viz.: the Eastern, the San Francisco, the River and Lake and the Western.

The following is a brief description of the adopted route, illustrated by the map. Here are represented the results of all these painstaking labors, which were accomplished amidst difficulties of the most discouraging nature at times. But the investigation was steadily and uninterruptedly prosecuted with the single purpose of reaching the truth, the whole truth, and nothing but the truth.

EASTERN DIVISION.

From San Juan del Norte Harbor to the San Francisco Basin, 18 7-8 miles.

For 9 1-4 miles from the inner harbor the line extends southwesterly across the lowlands of the coast to the first lock, which is in the foothills of the eastern divide. This reach will be at the sea-level and will be given a bottom width of 120 feet, surface width of 288 feet, and depth of 28 feet. The cross-section of the waterway contains 5,712 square feet, against 3,700 square feet at Suez. This reach becomes practically an extension of the harbor, for its width is sufficient to allow a continuous line of the largest ships to be tied up on one side and ample space left for the passage of others. The formation, as shown by borings, is entirely alluvial, and will be excavated by machinery throughout.

Lock No. 1

Will have a lift of 31 feet, and, like all others on the line, is to have a length of 650 feet, width of 80 feet—ample in dimensions to receive two vessels of 2,500 tons each—and founded on a very stiff, tenacious red clay. If it be urged that this will be an insecure foundation for so heavy a structure, and unable to withstand the water pressure, the reply is that the great lift-locks of the North Sea Canal, at Amsterdam, Holland, are founded on a soft mud flat, stability secured by some 6,000 wooden piles, which, in Nicaragua, will be unnecessary. Again, many of the best dry docks throughout the world, some

of them upwards of thirty feet in depth, are founded on piles, driven in soft mud. All the locks will be built of solid concrete masonry and iron.

Lock No. 2

Will be 1 1-4 miles beyond No. 1, and through the intervening space flows the little stream Deseado, which rises in the eastern dividing ridge. A dam in connection with the lower lock will raise the level of the waters some 20 feet above the present bottom of the valley, and through the flooded area the canal line passes only partially in excavation to the second lock, lift 30 feet, located in hard ground in a hill spur to the south of the valley just mentioned. This raises the water level 61 feet.

The embankments, which permit the formation of the second basin, have a maximum height of 38 feet, an average of about 20 feet, and 2,450 feet long. The only excavation here required consists in the removal of four low hills of clay. Thus, with a small amount of work, 1 3-4 miles of navigation is secured in a broad and deep basin, which supplies an ample and convenient passing place for the vessels proceeding in opposite directions.

Lock No. 3,

With a lift of 45 feet, is 1 3-4 miles from Greytown and very nearly 2 miles from the second lock. The Deseado, here hardly more than a smart brook, is spanned by other embankments of the aggregate length of 1 1-3 miles, the average height being 21 feet. By these means an artificial lake upwards of 3 miles is created, with a depth varying from 30 to 70 feet, and this without excavations, except in a few spots aggregating one-third of a mile in all.

It is proposed to maintain the water in this basin at an elevation of 106 feet; in other words, the summit or "lake" level is carried across the divide to Lock No. 3, only 1 3-4 miles from the Atlantic and 3 1-2 miles from the sea level reach, which, it will be remembered, extends inland from the harbor 9 1-4 miles. Provision is made for the discharge of the surplus water. This, in the engineer's plans, consists of weirs (or equivalent sluices), of which 1,400 feet running length are proposed.

As may be seen from the map, immediately above each lock is to be a large basin or reservoir, and their utility is apparent when it is known that the quantity of water required to fill the upper lock is over two and one-third million cubic feet. If this amount of water were taken from the average canal prism, very injurious currents and changes of level might result. Under the conditions that will exist no injurious or objectionable alternations of level or currents can occur.

THE "EASTERN DIVIDE" CUT.

About three miles beyond the upper lock, begins the heaviest cutting on the whole line. The piercing of this ridge enables the vessel to pass at one level from the Atlantic coast proper into the valley of the San Juan, that portion of which is intended for use in the transit being inundated, and the whole region for many miles becomes an extension of the interior lake. It is true the canal

could be made along the valley of the San Juan, but this would entail an increase of total distance of some twenty miles; there would have to be at least a half dozen locks on this side alone; and grave difficulties in disposal of the surface drainage would be encountered. After very careful consideration of all the governing conditions, a knowledge of which was arrived at after long study and the most painstaking surveys, it has been decided as by all odds the best plan to penetrate this ridge, and so gain the very valuable advantages of shorter distance, less obstructed and more rapid navigation, ample passing places, exemption from surface drainage difficulties, and ultimately of reduced expense of construction and maintenance.

This dividing ridge, which must be crossed by the adopted route, a spur of the main Cordillera, is 2.9 miles wide, and its crest, a mere "backbone," is 298 feet above the summit level. The average cutting for the distance given is 141 feet to the floor of the canal. The material to be removed is fortunately mostly rock, and steep side slopes will therefore be permissible. Of the total excavation required for the whole line 21 per cent. is concentrated at this locality.

The magnitude of this work grows less striking as we examine it in detail, and in connection with the whole work. Its advantages may be thus stated:

First. It is located on the direct line from San Juan to Ochoa—the two objectives; the one, of necessity the Atlantic terminus, and the other, the point where the line must join the main river channel.

Second. It is the lowest and narrowest point at which this ridge can be crossed and is nearly equi-distant from the objectives.

Third. The material to be removed is principally solid, homogeneous rock, thus ensuring a minimum of excavation and permanence of slopes.

Fourth. It will supply the material (rock) that must be had in building the dams at Ochoa and elsewhere along the line—the embankments, the locks, the breakwaters at Greytown, and rubble for pitching the canal banks. The material for most of these objects must be obtained in this ridge, as there is no other source of supply nearer San Juan or Ochoa.

Fifth. The locality is one of the healthiest in Nicaragua, the drainage being perfect and pure water abundant.

Sixth. Close at hand on both sides of the cutting is an inexhaustable water-power that can be utilized with great economy in driving the excavating machinery and lighting the works. These are the principal considerations that led to the resolution to push through this massive barrier. In fact, it is doubtful if the adoption of any of the alternatives for its avoidance would have left it possible to secure every desideratum of a transit route capable of fulfilling the rigid requirements that environ the undertaking.

SAN FRANCISCO DIVISION.

From the divide to Ochoa, 12 1-2 miles.

Near the crest of the dividing ridge rise two little streams, the Deseado and Limpio. The valley of the former a few miles below its source is appropriated by the canal on the east, just as is the valley of the latter on the west. Both

penetrate deeply into the dividing mass, and by utilizing the stream beds, wrought by erosion, we greatly reduce the magnitude of the work of uniting their drainage channels. For three-quarters of a mile, after leaving the end of the dividing excavation, the bed of the Limpio must be deepened to an average of 16 feet, in order to gain the requisite depth for navigation.

Also rising in the dividing ridge a mile or so to the north, and flowing west, is another brook, the Chanchos; this is joined by the Limpio in a valley of considerable width, the combined streams bearing the name of the former, falling into the San Francisco a little farther on. The San Francisco is a tributary of the San Juan, into which it flows 3 1-2 miles to the south. The lower course of this river is through a low and swampy tract of small elevation. Just above the junction of the Chanchos and San Francisco, in the angle between the two valleys, are some low hills. The canal line descending the Chanchos diverges from the stream and passes north of these hills through a low pass into the valley of the San Francisco proper. This it traverses for some 2 1-2 miles, crosses another low ridge to the Florida Lagoon, drained by the Danta, the latter being also a San Juan tributary. Traversing another succession of low ridges and valleys for 2 1-2 miles the canal will enter the Machado valley, a few hundred yards above its junction with the San Juan, and here is to be the

OCHOA DAM.*

This work, 1,900 feet long and 70 feet maximum height, is to raise the waters of the San Juan 56 feet to the lake level. Until engineers had satisfied themselves by close personal investigation that the level of the lake could be extended to this point and maintained, if necessary, all the way across the San Francisco basin, the Nicaragua Canal problem, and indeed the inter-oceanic transit problem, could not be considered as solved satisfactorily.

The distance from the divide cut to Ochoa is, as before stated, 12 1-2 miles, of which 7 1-2 miles of the line are tangents and the remainder consists of curves having a minimum radius of 4,000 feet. The hills bounding the line on the south do not form an unbroken range. Several gaps exist, and these must be closed by embankments aggregating a length of 3,440 feet, measured on the floor line, and 12,600 feet on the crest. The maximum height of these works taken at the proposed water level is 60 feet. Besides, 59 other minor embankments will be required with an aggregate length on crest line of 16,770 feet, for the hills do not always rise to the canal level.

Of the total length of the San Francisco basin 8 2-3 miles will be in flooded valleys of many times the width required, and from thirty to sixty feet deep. Of the remainder, 2 1-2 miles will be partly, and 1 1-4 miles wholly in excavation, the material clay.

Besides the economical advantages of securing such a large stretch of canal for so moderate an expenditure, there are others far more important. A few are specified.

First. Unless the level be raised, as proposed, the "divide" cut would

* An alternative location for this dam, which possesses some advantages, has been found two miles down the river, but it has not yet been decided to adopt it.

be of such proportions as to considerably increase its cost and the Deseado basin would be an impossibility.

Second. Free navigation through a wide and deep basin is secured instead of impeded navigation through a restricted channel. Ships can proceed at ocean speed, passing each other at will, while in an excavated channel their progress would be slow and confined to rigid conditions.

Third. The drainage problem is vastly simplified, for it must be remembered there is a liability, indeed, almost certainty, of rainfalls of six inches in twenty-four hours. The watershed of San Francisco has an area of about sixty-five square miles, and were the canal wholly in excavation at about the natural level of the San Juan, the exclusion of the surface water, an indispensable pre-requisite, would be well nigh impossible. Our designs provide for many square miles of reservoir that will equalize and store the floods, and the outlets are so extensive and ample that no harm to the works can result. The lineal extent of the weirs and sluices is 4,750 feet, and, assuming there is no leakage, the maximum depth of water on the crest of the spillways could not exceed fifteen inches in the highest flood. Guard gates may be placed in the three short sections of the canal along this route, so as to isolate each subdivision of the reservoir, if desired.

LAKE AND RIVER DIVISION.

From Ochoa Dam to West Shore of the Lake 121.04 Miles.

The Ochoa dam is to hold the waters of the river permanently at the height of 106 feet above the sea. The lake level is to be 110 feet. The difference, three-quarters of an inch per mile in the 64 miles of river, is taken as the slope necessary to enable a free discharge of the lake and river waters, which have been estimated as reaching 20,000 cubic feet per second. By this dam, slack water navigation all the way to the lake will be secured, and with the exception of 28 miles above Toro Rapids, the navigation channel will be 1,000 feet wide, and from 28 to 130 feet deep. Rock blasting and dredging above Toro to the lake will be required to an average depth of 4 1-2 feet in several localities, in all for 24 miles. When the river channel is deepened it will have a bottom width of 125 feet and a top width from 500 to 1,500 feet. Besides, at two or three points the river bends will be improved by removal of projecting promontories, so as to decrease abruptness of the curves. The Costa Rican tributary, San Carlos, debouches into the Rio San Juan a few miles above Ochoa. The hills bounding its valley on the east are not continuous at the proposed water level, and several embankments of inconsiderable height will be required to retain the waters backed up in the San Juan. This inundated valley will become navigable and of vast benefit to Costa Rica, because it will bring navigable waters twenty miles nearer to her capital.

Dredging in Lake Nicaragua to an average depth of ten feet in soft mud, bottom width 150 feet, will be necessary for fourteen miles from the shore to secure a navigable channel of thirty feet to deep water.

THE LAKE.

From the San Juan outlet of the lake to the mouth of the Lajas is 56 1-2 miles. For upwards of 42 miles the natural depth varies from 30 to 150 feet. The west coast of the lake is shoal for 1,400 feet, and deepening will be necessary here also. It has been estimated as rock, such being the indications.

The trade winds make considerable swell on the west shore, and jetties will be necessary to insure a safe entrance to the canal. They will be cribbed constructions, filled in with rock. Their lengths will be 1,800 and 2,400 feet respectively.

The mean level of the lake is about 105 feet above the sea. It will be increased to 110 feet by the Ochoa dam, and the dredging and deepening spoken of are predicated on this raising of the level.

WESTERN DIVISION.

From Lake to Pacific 17.04 Miles.

Of this distance 11 1-2 miles will be in excavation and 5 1-2 miles in the Tola basin. The excavated portion joining the lake to the basin is 9 miles long, and the deepest excavation pierces the continental divide by a cut through the ridge, which is here 42 feet above the canal level and 153 feet above the ocean mean tide. For a distance of about 5 miles through the deepest cutting, principally rock, a bottom width of canal of 80 feet is proposed. The approach to this section from the lake, 1 1-2 miles long, will have a bottom width of 120 feet and top width of 210 feet.

Beyond the divide to Tola basin the line follows the Rio Grande, having a bottom width of 80 and a top width of 184 feet. The basin is 5 1-2 miles long, and no work whatever is required in it for 4 1-2 miles.

THE TOLA BASIN.

The dam at La Flor is to be 1,800 feet long and 70 feet high, and inundates 4,000 acres of grazing and wooded land in the valleys of the Grande and Tola.

The average width of the sailing line in the basin will be a mile and the depth of water from 30 to 70 feet.

Locks 4, 5 and 6.

Locks 4 and 5, close together near La Flor, have lifts of 42 1-2 feet each. No. 6 will have a variable lift from 21 to 29 feet, according to the tide. It is 1 1-2 miles below La Flor, and the canal prism intervening has bottom width of 80 and top of 184 feet. Locks 4 and 5 are founded upon rock, and No. 6 upon indurated clay. From the lower lock to Brito, 1 1-4 miles, the canal will be at the level of the sea, and as its bottom width is 120 and top 288 feet, this section becomes practically an extension inland of the Brito port.

The lake level, or summit reach, is prolonged to Lock No. 4 below the Tola basin, and as the western entrance to the basin is but 3 1-2 miles from the Pacific, this broad sheet of water becomes practically an accessory port, so to speak.

The dam, which maintains the basin, is the most massive of any required on the line of the canal, although its height and mass are much less than that given many earthen embankments located in different parts of the world, some of which have been fulfilling their purposes for centuries.

As the discharging capacity of the lock sluices will be some 4,500 cubic feet per second, it is thought there need never be a flow over the weir, even in periods of flood, considering that the flood waters from the Grande and Tola can have free escape to Lake Nicaragua, by way of the canal itself, but as a precautionary measure there will be a guard gate in the divide cut so that the waters of the lake may be excluded.

HARBOR OF GREYTOWN.

Some thirty years ago this was a good and capacious port. An area of about 500 acres, having 20 feet of water and upwards, was nearly enclosed on the sea face by a sand spit joining the main shore to the eastward; between the western extremity of this spit, or "hook," and the main land still farther west and north, was the harbor entrance, and although narrow, it was easily traversed by vessels of 25 feet draft. Due to well-known causes which need not now be described, the entrance has been blocked up, and the old harbor become an inclosed lagoon.

The plans for the restoration of this port are based on long continued observation and investigation, and on experience gained elsewhere; they particularly take cognizance of the fact that the northwesterly movement of the ocean sands (brought to the coast from the Costa Rican Mountains by the Lower San Juan and its tributaries) under the influence of the prevailing winds extended the sand pit entirely across the entrance and sealed the port.

It is intended to oppose to the further movements of the sand drift a solid jetty or breakwater, about 3,000 feet long, projecting seawards at right angles to the shore line, to the 6-fathom curve, then to dredge under the lee of this jetty a new entrance. The shifting sands, arrested by this structure, will accumulate in the angle formed by it and the coast. As the triangular space becomes filled, the water may shoal towards the sea end of the jetty, and this will necessitate its extension until the new shore line is at right angles to the prevailing wind, which it will be remembered is the northeast "trades." Eighteen hundred feet of the jetty, constituting its shore end, is to be built of creosoted timber, filled in with rock or concrete and fascines, the stone to be brought from the divide cut and laid or deposited at random.

The entrance channel is to be 30 feet deep and 500 feet wide at that depth. The inner basin or harbor proper, the depth of which is to be increased to 30 feet, is to have an area of upwards of 200 acres, which, with the enlarged section of the port reach of canal, gives a total harbor area of about 350 acres, exclusive of the remainder of the inner bay, where, throughout a considerable area, there is now a depth of from 10 to 20 feet.

The first 1,000 feet of this protection jetty has been already built, and the result has proved a complete demonstration of the accuracy of the theory on

which the design was based, for, where a few months ago there was a dry beach, is now a channel of depth sufficient to admit vessels drawing 12 to 15 feet of water.

BRITO HARBOR.

This is of necessity the western terminus, and although not now a harbor in any proper sense of the word, or even a roadstead, yet the practicability of constructing a harbor at this point has never been questioned, the only difference of opinion being as to details.

The Rio Grande discharges at this locality, and its lower course for 6,000 feet back from the beach is through a low valley, which it is believed once formed a large bay or harbor. A high rocky promontory connecting with the interior ridge juts out into the ocean just north of the river mouth. It is proposed to build from this rocky point a breakwater 900 feet long, its extremity to be in seven fathoms of water; also to build another jetty, normal to the beach, 830 feet long, the extremity of the latter to be nearly opposite and some 800 feet distant from the sea end of the former. A considerable area of deep water will thus be enclosed; but the principal portion of the harbor will be formed by excavation in alluvium, thus securing a deep, broad basin, penetrating 3,000 feet from the present shore line and 3,900 feet from the entrance. As an extension of the harbor, the canal itself is to be excavated with an enlarged prism to the first lock, which, as previously stated, is 3,000 feet farther inland. An area of nearly 100 acres will thus be inclosed, and with the enlarged canal will make upwards of 100 acres. Should this space be found insufficient, it may be increased to any extent desired by excavating in the adjoining lowlands, which are now submerged at high tide. Besides, it must not be forgotten that the Tola basin is but 3 1-2 miles away, and affords a perfect harbor for a hundred of the largest ships.

CAPACITY OF THE CANAL.

The experience gained at Suez has been profited by. There the bottom width is 72 feet, and it has been found that 6,000,000 tons per annum cannot be passed without serious delays to navigation. A widening of the prism at various places has been in progress for some time, but throughout the 100 miles included in this transit, there is but one basin *en route* of sufficient depth and width to permit vessels to pass, and this is but 10 or 11 miles long. At one other point there is a lake in communication with the canal into which vessels may diverge and anchor. It has been noticed that the longest single reach of the Nicaragua Canal in excavation is less than 10 miles in extent, and the passing places are frequent and ample. Throughout, there are but 70 miles where any work at all is needed to secure a sufficient width and depth, and there are nearly 100 miles of free navigation that will not need a stroke of work.

But notwithstanding these favoring conditions it was felt to be necessary to provide at first for a waterway of the most ample capacity. Of the 26 3-4

miles of excavated channel, but 13 1-4 miles have as small a bottom width as 80 feet, which is 8 feet greater than at Suez. The remainder has a bottom width of from 120 to 150 feet, and the top width varies from 80 feet (confined to the two "divides") to 288 feet. If it be thought necessary, these two rock cuts may be increased in width to 100 feet, at an increased cost of the whole work of some 6 per cent.

The locks will be the longest hitherto built; in fact there is but one in existence comparable—that at St. Mary's Falls, connecting Lakes Superior and Huron. This is 515 feet long and 80 feet wide, and when the chamber is in communication with the upper reach the water is 39 feet deep. It is filled in 11 minutes and emptied in 8 minutes. In 1889 4,684 vessels, carrying 7,516,000 tons of freight were passed, and last year upwards of 9,000,000 tons. But this lock is of insufficient capacity to meet the requirements, and now the government is engaged in building a new one 800 feet long and 100 feet wide, with a depth of 21 feet on mitre sills. However, at St. Mary's the governing conditions are not the same as will be at Nicaragua. There the vessels average small, one steamer frequently towing two or more large barges, and great area is therefore required. The vessels which will frequent the inter-oceanic transit will be larger, and the need of locking more than one at a time will be of less frequent occurrence. It has, therefore, been decided that a 650-foot lock, 80 feet wide, will be sufficient for all present and all except remote future needs. When this condition arises, it will be necessary to build a second series of locks, provision for which will be made at the outset.

For a single lockage 45 minutes are allowed, and assuming that only one vessel will enter at a time, 32 can pass in 24 hours, or 11,680 in a year. If these vessels have the same size as those frequenting the Suez Canal, their aggregate would be the enormous figure of 20,440,000 tons. Of course this involves continuous navigation, night and day.

With respect to time required for passing vessels from ocean to ocean, the governing conditions of depth, width and directness of the route in its several parts must be regarded. At Suez, although the regulations of the company prohibit a speed of more than 5 1-2 miles per hour, yet some of our own naval vessels have exceeded a speed of six knots, say seven statute miles; the "Tennessee," for example, in 1875, drawing 23 3-10 feet. In the Bitter Lakes, where there is free navigation for some 10 miles, the regulations allow steamers to proceed at the usual speed, as they will in the Nicaragua lakes and basins. The Suez Canal is now lighted by electricity throughout, and the passage is effected from ocean to ocean in less than twenty-four hours.

The Chief Engineer has estimated for a speed of 5 miles per hour in the reaches of the canal where the sectional area of the prism is upwards of 3,600 square feet, and for a speed of 2 1-2 miles in the deep rock cuts, where the top and bottom widths are but 80 feet. He assumes a speed of 7 miles in the basins, of 8 miles in the River San Juan, of 10 miles in Lake Nicaragua, and 45 minutes for passing each lock. We then have the following:

ESTIMATED TIME OF TRANSIT.

	H.	M.
7.841 miles narrow canal at 2 1-2 miles per hour . . .	3	04
18.189 miles broad canal, at 5 miles per hour . . .	3	38
21.619 miles basins at 7 miles per hour, . . .	3	05
64.540 miles San Juan River, at 8 miles per hour . . .	8	04
56.500 miles Lake Nicaragua, at 10 miles per hour . . .	5	39
Lockages, 6, at 45 minutes each . . .	4	30

169.448 miles, total time of transit . . . Hours 28 00

The average time of transit at Suez—100 miles—is 24 hours.

WATER SUPPLY.

The outflow of the lake has been gauged by several engineers, and the least reported, when the river was at its lowest stage, is 11,390 cubic feet per second. The flood discharge has been estimated by several engineers at 18,000 cubic feet per second. The mean flow is, therefore, taken at 14,724 feet, or 1,272,530,600 cubic feet per day.

The water required for one lockage on each side is about four and a half million cubic feet, and for 32 lockages 144,000,000 cubic feet. The supply is, therefore, about nine times greater than needed.

It is expected, and indeed hoped, there will be for some years considerable leakage through the rock-filled dams, so affording time for the thorough consolidation of the embankments, and this will relieve the discharge at the overflows and sluices.

One word in regard to these dams, because some have expressed grave doubts as to their stability and practicability. If no such works had ever been executed the justice of the criticism might be admitted. The fact is, that the dams and embankments proposed, although colossal (more in respect of number and quantity of material required for their construction than as regards the dimensions of the largest), have had many parallels in the history of engineering, and have been surpassed by many. Leaving out of consideration the great masonry dams, there is here given a few examples of dams built of earth.

Montaubry dam in France, built to secure slack water navigation for a canal, is 54 feet high.

The water supply of Dublin is derived from a reservoir impounded by a dam 66 feet high.

The reservoir dam of the Bolton Water Works, in England, is 120 feet high.

The Oued Muerad dam in Algeria, is 95 feet high.

The embankment of the Ashti reservoir is 58 feet high, and 12,750 feet long.

The Karak-Vasla dam is over 70 feet high.

The Tansa dam, Bombay, is 118 feet high and 8,500 feet long.

The Cummun dam, in India, built a thousand years ago, is 102 feet high.

This is a sufficient answer to the incredulous.

THE ESTIMATED COST.

This estimate of cost is the result of very careful computations of all the works and accessories incidental to completion, and is based upon the most recent and accurate data. Thousands of borings have been made at points where work is required, for example, at all the deep cuttings, embankment sites, and lock sites, and where the material is rock, the cores brought up by the diamond drills have been preserved for inspection. Whenever there is a doubt as to the character of the material to be removed, the worst is estimated for. Of the 26 7-8 miles of canal in excavation, more than 12 miles will be done by improved dredging machines, the material to be deposited directly by the dredges on both sides of the cutting.

There are some 10,000,000 yards of excavation in the great divide cut, of which 7,000,000 are rock. The dumping ground for the earth is close at hand, and a large portion of the rock will be required in the San Juan breakwater, and in the numerous locks, dams and embankments. On the western division there will require removal some 12,000,000 yards, nearly one-half rock, but this comes from comparatively shallow cuts, and a large quantity will be needed in harbor, lock and embankment work. There will be nearly 10,000,000 yards of dredging at San Juan, and 5,500,000 at Brito. These are some of the principal items of works. The following is a general summary of quantities and estimated cost of units:

EXCAVATING, ETC.

34,654,737 yards dredging at 20 cents.
 5,390,605 yards dredging at 30 cents.
 15,596,081 yards earth excavation at 40 cents.
 214,785 yards earth excavation at 50 cents.
 6,587,185 yards rock excavation at \$1.25.
 7,030,539 yards rock excavation at \$1.50.
 575,445 yards sub-aqueous rock excavation at \$5.

70,049,377 cubic yards total excavation.

EMBANKMENTS.

1,748,000 yards earth from cuts at 20 cents.
 629,090 yards earth from cuts at 25 cents.
 4,076,034 yards earth from cuts at 30 cents.
 1,786,084 yards rock from cuts at 40 cents.
 996,936 yards rock from cuts at 50 cents.
 293,240 yards earth from cuts at 70 cents.
 383,899 yards rock from cuts at \$1.50.

9,913,283 yards total embankments.

MASONRY.

614,101 yards concrete at \$6.
 1,550 yards concrete at \$10.
 19,080 yards stone at \$10.

634,731 yards total masonry.

STONE PITCHING.

262,641 yards protecting banks at \$2.

CLEARING LAND.

3,427 acres at \$100.

Other important items of expense provided for are electric lighting the whole route at half-mile intervals from end to end and 30 arc lights for each lock.

Railroad for construction purposes, 45 miles main line, at \$60,000 per mile. Electric telegraph lines are included, 80 miles.

For machinery, buildings at the locks, including gates, fenders, wales, etc., nearly \$2,000,000 are allowed; this for lock equipment alone.

The following is a recapitulation of Mr. Menocal's estimates, corrected to January 31, 1890:

RECAPITULATION, EASTERN DIVISION.

Section 1, from Greytown to the Divide	\$3,950,523 40
Section 2, the Divide	11,786,106 60
Railroad and Telegraphs	731,000 00
Lock No. 1	1,271,059 10
Lock No. 2	1,111,501 10
Lock No. 3	1,631,671 20
Harbor of Greytown	2,649,575 00
Auxiliary Works	554,611 90
	<hr/>
	\$23,686,048 30

RECAPITULATION, SAN FRANCISCO DIVISION.

Excavation, lighting, clearing, etc	\$1,562,241 50
Railroad and telegraphs	920,000 00
Embankments and weirs in valley of the San Francisco	2,681,076 60
	<hr/>
	\$5,163,318 10

RECAPITULATION, LAKE AND RIVER DIVISION.

Section 1, River San Juan	\$2,888,701 00
Section 2, Lake Nicaragua	1,857,825 20
Embankments in San Carlos Ridge Line	219,893 00
Dam across Rio San Juan at Ochoa	726,137 50
	<hr/>
	\$5,692,556 70

RECAPITULATION, WESTERN DIVISION.

Section 1, canal	\$9,753,849 35
Diversion of the Rio Lajas into the lake	305,785 70
Railroads and telegraphs	459,000 00
La Flor dum	577,520 00
Locks Nos. 4 and 5	1,946,720 40
Tidal Lock No. 6	1,248,395 90
Other auxillary works	1,139,018 00
Harbor of Brito	1,720,128 10
Right of way indemnity	100,000 00
Tipitapa Canal	275,000 00

\$17,525,417 45

GRAND RECAPITULATION.

Eastern Division	\$23,686,048 30
San Francisco Division	5,163,318 10
Lake and River Division	5,692,556 70
Western Division	17,525,417 45

\$52,067,340 55

Surveys, hospitals, shops, management and contingencies, 25 per cent	13,016,835 45
--	---------------

Grand total \$65,084,176 00

Early in the year 1889 the engineering estimates, plans and all official data that had been previously collected, and that had a bearing upon the technical question were submitted to a board of distinguished civil engineers for their revision and opinion.

The gentlemen referred to were:

Mr. John Bogert, State Engineer, State of N. Y.

Mr. E. T. D. Myers, railroad engineer, Richmond, Va.

Mr. A. M. Wellington, editor *Engineering News*, of New York.

Mr. H. A. Hitchcock, Prof. Engineering, Dartmouth College.

Mr. Charles T. Harvey, former Chief Engineer, St. Mary's Falls Locks.

All are well-known and distinguished in their profession. The report of these gentlemen is an exhaustive document, going at length into all the details. The full text will be found in the Appendix.* They give their reasons in full for increasing some of the estimates submitted and make a much larger contingent allowance than did Mr. Menocal. They estimate the total cost of the work at \$87,799,570, and conclude their able report with the following paragraph: "In conclusion, we think it proper to express our opinion that the explorations and study of the region have been sufficient to warrant the conclusion that, unless hindered by obstacles or sinister influences such as would, if permitted to weigh, forbid the success of all ventures, this enterprise is full of promise."

It should be noted that the data upon which this board of consulting engineers made their computation and review was less complete in details than that used by Mr. Menocal one year later in his final estimates.

*See Appendix No. 8.

CHAPTER V.

THE WORK ACCOMPLISHED.

The historical sketch given in Chapter I. of this pamphlet, contains a very brief account of the initiatory steps taken for completing the knowledge of topographical details along the line of the proposed canal, and for commencing the work itself.

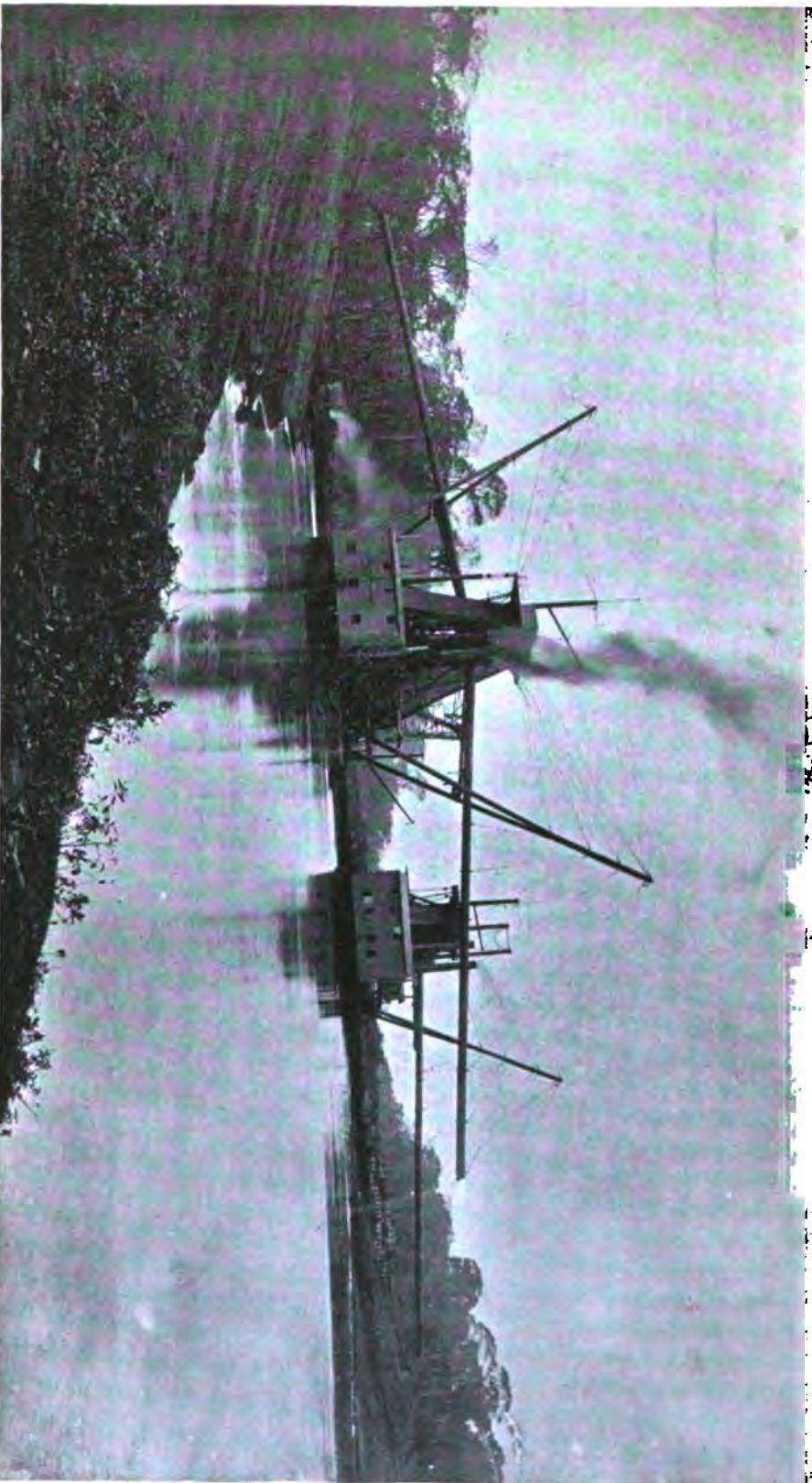
It will not be here attempted to state the details of the preparatory operations and execution, but rather to summarize the means employed and results accomplished to November 1st, 1891.

It will be remembered that the contract entered into by the Nicaragua Canal Association and the Government of Nicaragua, which provides for the opening of this route to inter-oceanic transit, was duly ratified by the Congress of the Republic on the 24th of April, 1887, so becoming a law of the land; and on the 30th of November of the same year the first engineering expedition was dispatched from New York. This expedition was entrusted with the duty of making the final surveys and location for construction. The work was fairly under way by the beginning of the year 1888, and had been substantially completed by the close of the same year, permitting the preparation of plans for construction, and the detailed estimates of quantities and cost.

Although some months elapsed after the completion of this important preliminary before the voluminous plans and detailed drawings were approved by the Nicaraguan government, and the work of construction permitted to begin, yet a corps of engineers was kept constantly employed, and when construction work was initiated, this force only needed to be properly augmented. The first reinforcement was sent out in May, 1889, and others followed from time to time as necessities required, so that by the close of the year 1890 a force of nearly 2,000 officers, foremen and laborers were actively employed.

Upon the open, unprotected sea beach in front of the Greytown lagoon—which was the former capacious harbor of San Juan del Norte—all supplies had to be landed, and this, in itself, was a very serious and expensive operation, for the vessels had to lie at anchor in the open roadstead two miles from land, where they were almost constantly exposed to the northeast “trades.” These winds here usually have a velocity of 20 miles an hour, and of course produce a violent surf, which had to be passed through in each trip between ship and shore. So difficult and tedious was the landing of cargoes there during the earlier operations before the opening of the harbor, that it was no uncommon occurrence for vessels laden with only ordinary packages of goods to depart without discharging their freights.

At first it was attempted to house the engineering force and workmen under canvas; but experience soon showed that this material was neither an economical nor suitable shelter. During all the surveying and other preliminary work



THE DREDGES "CITY OF PARIS" AND "M. A. SLAVIN" WORKING ON THE EASTERN END OF THE CANAL.

inland, and even up to the present time, the workmen of all classes have lived in temporary shelters, thatched with palm leaves, and many thousands of dollars have been expended for labor (there was no other outlay) on such structures.

The surveys were necessarily slow and expensive, for they were prosecuted in a tropical forest, where nothing could be seen at a distance of 50 feet, and where every step had to be preceded by the blow of a machete to clear away the tangled mass of vines and other vegetation that everywhere obstructed progress. The country along the line from San Juan to Ochoa was entirely without highways or other means of communication, except in a few localities, where navigation of the small streams was possible by canoes after clearing the water courses from logs, stumps and other obstructions. From the small coast settlement of San Juan, where all supplies were landed and stored, all the way to Ochoa, a distance of 30 miles, the method of transport of provisions and all other supplies, except in the restricted localities where canoes could be used, was similar to that employed by explorers in the heart of Equatorial Africa, viz.: packs of suitable weight borne on the shoulders of men; up and down hills, so steep that support in climbing must be had from the brushwood or trees, much of the time with the rain pouring in torrents; through marshes and swamps, where for long stretches the men had to flounder along in water and mud waist deep; and this through a wilderness as wild and trackless as that about the headwaters of the Congo. No description can give an accurate idea of the tediousness, difficulty and weariness of this task.

The government and other surveys by Childs and Menocal previous to 1886 had sufficed to demonstrate the feasibility of the general line of the San Juan River and Lake Nicaragua from Greytown to Brito for the Inter-oceanic Ship Canal route, but the present company, appreciating the importance of ameliorating, if possible, the difficulties to be encountered, could not properly omit the most careful investigations of very extended adjacent areas, in the hope of revealing an improved location in whole or in part. While the government survey of 1872 served to demonstrate the entire practicability of the Nicaragua route, it will be interesting to know that of the line as now located between the Atlantic and the San Juan River at San Carlos mouth, and also between the Pacific and Lake Nicaragua, a total distance of some 49 miles, but about 8 1-2 miles in extent of present location, coincides with the government route of 1872.

The government survey of 1885 proved the superior advantage of a line diverging from the San Juan River near the mouth of the San Carlos; over the earlier location of 1872 in the San Juan Valley, but the execution of the work on this route, remote from the river, involved the piercing of a ridge or spur of hills at a point which was some 500 feet high, unless a lower and practicable pass could be found, but the dense forest prevented an easy determination of this point. The passage across this ridge was but three or four miles long, yet, in order to eliminate all doubt, and make certain that no improvement was possible, it was necessary to examine the whole watershed and the approaches thereto for many miles on either flank; to meander every neighboring creek and rivulet, to their origin on the divide, in fact, to examine about every square rod of this highland, so as to permit the accurate plotting of all the information

and the correct representation of all the topographical details on charts, that could be studied at leisure.

Therefore it is that the examinations have covered not only the one line first selected, but any and all routes that presented any indications of practicability. So, too, has it been necessary to explore every range of neighboring hills, and every small stream, in order to determine the limits and area of basins drained by streams flowing to or across the canal line. The Costa Rican bank of the San Juan River was critically examined from Rio San Carlos to the Colorado bifurcation, in the hope—which finally proved elusive—of finding a practicable site for erection of a dam 20 miles below Ochoa, that would permit the avoidance altogether of the ridge before mentioned, and the location of the line from the supposititious site of the dam at point Sarapiquí through the San Juanillo valley to the port at San Juan del Norte; but the whole country on the Costa Rica bank of the river back for several miles was found low and flat, intersected with creeks and lagoons, forbidding the further consideration of the alluring suggestion of inundating the lower San Juan, and so saving many millions of expense in heavy rock cuttings; but it cost much time and money to ascertain that this idea, which had been urged by some intelligent men, was impracticable.

So soon as the first corps of engineers was landed, the surveying parties were organized and at once pushed out. Traversing the low lands for a few miles back of Port San Juan, were some sluggish streams whose courses favored the idea of utilization for water-borne carriage of supplies. A steam snag boat was immediately set at work removing the obstructions, and barriers too heavy and massive for displacement otherwise were broken up with dynamite. The San Juanillo and Deseado were thus cleared and utilized for a distance of upwards of thirty miles of their course, but the streams were so crooked that the actual land mileage accomplished was only about one-third the distance by water. Then trails for the packers were cut out, foot bridges built across impending streams and ravines, so that supplies could be transported with certainty though slowly to and beyond the eastern divide.

The San Juan River has long been used by a steamboat transportation company, and a large part of the produce of Nicaragua has for forty years been moved from the interior by this route. Steam transport, via the river, was, of course, availed of by the engineers when it served their needs, but much of the surveying work was remote from the river, and hence its unavailability, except in the region beyond "the divide" towards Ochoa, where the canal and river were in closer proximity. As will be seen by reference to the map, the canal line, beyond the dividing ridge, intersected the valleys of the San Francisco, Chanchos and Danta. The channels of these streams were also cleared and made available for canoe traffic from the San Juan River.

Numerous camps and depots of supplies were constructed and stocked wherever necessary, and fleets of light steel canoes were employed as means of communication and supply.

The idea was early entertained of utilizing the channel of the San Juan River for slack water canal navigation, and thus making it serve as a portion of the In-

ter-oceanic ship transit route. The Childs survey of 1851 demonstrated its suitability for such use and the Government survey of 1872 confirmed Childs' observations and deductions, but in both these projects it was proposed to construct at each of the principal rapids, dams and locks of low lifts, and thus to convert the stream into a series of pools or reaches. The general level of the canal at any point would, therefore, conform closely to the natural level of the river. Such a treatment of the problem would have precluded the shortening of the line and reduction of the expense gained by the adoption of the nearly direct "overland route" from this point to the sea.

The excavation involved in passing from Rio San Carlos, at the point of divergence, through the eastern divide at the natural level of the waters in the river, would have demanded double the work and expense that should suffice if the "lake level" were extended to Rio San Carlos, and then maintained all the way through the eastern dividing ridge as is now proposed.

The confident belief was early expressed by the Chief Engineer that a series of low dams in the upper San Juan was not the best treatment, for he believed the "lake level" could be maintained to or below the junction of the San Carlos, and so the rapids in the river could be all submerged, but he realized that this treatment would demand, as a *sine-qua-non*, the erection and maintenance of a massive dam—across the main stream near the point where the canal diverged—high enough to raise the water level at its site to the same level as that proposed for the lake itself; in other words the dam had to be high and strong enough to hold back the flow of this powerful river when its level should be raised 56 feet. It was soon ascertained that the natural conditions, at a place named Ochoa were favorable, as to the width of stream, character of bottom and solidity of abutments, for the erection of such a dam, but on further examination of Costa Rican territory it became necessary to make sure that the waters when so raised would not escape through the hills and lowlands bordering the river on this bank. Surveyors spent many weeks in this investigation, and secured exact information that fortunately proved the feasibility of the plan of embaying the waters of the river, and converting its valley into an extension of the lake, upwards of 60 miles in length.

The information collected by former expeditions in regard to the topography west of the lake was so complete that to elucidate the problem of quantity and cost, less new surveying work was there required than along the eastern portion of the route. Nevertheless, the whole line was re-surveyed, and the additional information thus secured enabled the engineer to introduce important changes and improvements in location and plans of construction, that could not be embraced in the earlier designs.

But the work of the surveyor was not ended with the completion of these studies of the ground for final location. It was impossible to classify the material to be removed and assign a cost per unit, until exact knowledge was had of the nature of the concealed strata in all localities where excavations would be required. So the surveyors for "final location and construction" had to be equipped, not only for obtaining an accurate knowledge of the surface of the earth, but as well of the strata beneath the surface. For this purpose a boring

and drilling equipment was provided, with which, at the site of all important works, such as dams, embankments and locks, as well as at the points where heavy cuttings will be required, subterranean examinations have been made in great numbers. Earth augers were used where there was no rock, and when this was encountered the annular diamond drill was used, and cores of the rock itself brought up and preserved for future reference and examination by engineers and contractors proposing to submit tenders for work. Owing to the transportation difficulties, steam drills were impracticable and the work was accomplished with hand power.

Although a corps of engineers, mechanics and laborers for commencing the construction was sent out in the summer of 1889, the work itself was not formally inaugurated until the 8th of October of this year, but much valuable preparatory work was done meanwhile, such as the commencement of the erection of permanent quarters, wharves, store-houses, clearing the ground and accumulating supplies, tools, etc.

The necessity of securing a safe entrance to the old harbor (which, until 1860, was easily accessible to vessels of upwards of 20 feet draft), was realized as indispensable to economical and rapid progress, and the first work begun of actual construction was in execution of the engineers' plans for restoring the harbor. One of the means to this end was the erection of a breakwater for protection of the entrance, of which a description will be found in another chapter. This massive work which will ultimately absorb many hundred thousand cubic yards of the rock excavated from the "divide cut" has been pushed out about 1,000 feet, and is continually being filled in with mattresses, rock and hydraulic cement concrete. Quarters for accommodation of the workmen and storage for supplies were erected near this work. A railroad track was laid upon the breakwater as it advanced, and was extended landward to a point whence was brought the building material and other supplies. In this breakwater, creosoted piling only is used in the frame work, as the marine worm (*teredo navalis*) would soon destroy unprotected wood.

The bar in front of the old San Juan harbor, which, in 1860, was closed by a sand spit formed, across its entrance, has since been known as one of the most dangerous on the coast. From the beach to and across this bar the breakwater had to be constructed and, therefore, it encountered the full force of the waves, but it has been carried forward through the heavy surf, without stopping at all on account of the weather, and without accident of any kind.

As the pier advanced, it afforded a partial shelter to the beach to leeward, and also served as a barrier to the moving beach sand, which, impelled by the waves and prevailing winds had formerly been driven constantly to the westward, and so built up and maintained the sand spit that thirty years ago closed the old port San Juan.

This artificial interruption to the operation of the winds and current, which were always active in bringing sand for building and renewal of the beach, permitted countervailing forces of nature to come into play; and the result was that, by the time the pier had been pushed out 600 feet, the sand beach under its lee, was swept away and an open channel formed, communicating from the

open ocean to the old harbor, now restored to the extent of permitting the entrance of light draft sea-going vessels, and this at a point where six months before was a sand bank three or four feet above the sea level.

The attainment of this result was without assistance of a dredge or any other artificial aid than that afforded by the breakwater. A most important deduction is evident from this experience, namely: That the plan devised by Mr. Menocal for the restoration of the port of San Juan, which some engineers had declared to be impracticable, is sound.

The building of this important work has steadily progressed as materials were available, and its total length is now 1,000 feet. The outer end is in 20 feet of water, and a force is constantly engaged in filling in the spaces between the piles with mattresses, rock and concrete. The depth of the channel under the lee of the pier reached 10 feet when the structure had been extended to 800 feet. In the winter of 1890-1 a dredge increased this depth to about 15 feet, and this has been maintained since, except in very restricted areas, which are easily deepened by the dredging machines, if necessary. The first deep sea vessel to enter the restored port was the steamer "Sverdrup," with a cargo of machinery, etc., on the 7th of January, 1891, and since then many other vessels have frequented the port.

During the Summer of 1889 permanent buildings were begun, and building constructions have been in progress ever since. The structures are all of wood (pine from the United States), and roofed with corrugated galvanized iron. The offices, quarters and hospitals are all ceiled and painted inside, have wide verandahs outside, and are neat and comfortable. All the permanent buildings so far erected are in the immediate vicinity of San Juan, for at this point is located the General Head-quarters, and here have been concentrated the most important operations.

The buildings now occupied consist of five groups (all near the sea beach), and have the floor space stated below:

Headquarters,	8 buildings,	-	-	-	-	13,986 sq. ft. floor.
Hospital,	10 "	-	-	-	-	14,174 " "
La Fé Depot,	8 "	-	-	-	-	21,864 " "
R. R. Headquarters,	9 "	-	-	-	-	18,778 " "
Camp Cheney,	4 "	-	-	-	-	7,100 " "
	<hr/>					<hr/>
Total,	39 "	-	-	-	-	75,902 " "

Besides the above, there are numerous and extensive wharves, equipped for unloading freight, sheds, small outhouses, water tanks, etc. The machine and smith's shops are equipped with a varied and extensive assortment of modern machine tools, and a tramway connects the more important of these establishments.

The concession allows to the enterprise (Arts. XVII., XVIII., XIX. and XX.) all the lands required for any and all purposes incidental to the construction of the whole work, including accessories, and this without charge or cost where the lands required belonged to the government at the date of the conces-

sion. In case the lands appropriated by the canal belonged to private owners: compensation for them must be made, the amount determined by the usual proceedings of condemnation and expropriation. The 1,000 manzanas of land (1,723 acres) referred to in Art. XX., have already been placed at the disposal of the company, and payment has been made in the sum of \$50,000, as provided in the article referred to. East of the lake, and all the way to the Atlantic coast, the whole district is unsettled, save by a few fruit growers, and the title to the lands still vests in the republic; therefore the cost of expropriations here will be merely nominal.

Work in clearing the canal line of forest growth was begun in January, 1890, and for a distance of about 10 miles back from the coast, the clearing has the full width of 486 feet. The same work was commenced on the west side of Lake Nicaragua in the month of November, 1890, and for a distance of 9 miles this ground is made ready for the active construction work.

The necessity for a telegraph reaching to the interior, connecting with the telegraph system of the country and the ocean cables, very soon became apparent. This was one of the first works commenced; it was soon pushed through to Castillo, with its loops amounting to 60 miles. The first ten miles of the line back of San Juan was across a very difficult swamp, where the work was most arduous, and the poles, which were made of native timber, were difficult of procurement, and together with all other supplies had to be carried by men wading in water from 2 to 4 feet deep. The water was so deep that in some places poles could not be set in the earth at all. In such cases they were wired to tree stumps, and otherwise supported by wire guys. Through the hill country the line was also an expensive one to build and is very difficult to maintain. To ensure immunity from falling timber, a clearing of the forest was necessary 100 feet wide. All the offices and more important camps and stations are in telephonic communication.

A quarry was opened at Silico Lake, some 15 miles distant from the harbor, and thence was brought in lighters at heavy expense for rehandling a considerable quantity of rock for the breakwater, but this source of supply was soon exhausted.

As the heaviest body of work to be accomplished on the whole line is concentrated within a distance of three miles, at what has been designated as the "Eastern Divide," and, as the time that will be required to complete the canal is measured by the time spent in the opening of this deep cut, it was felt to be important to install a plant for this heavy rock cutting at the earliest date possible. But so great were the difficulties of transportation of heavy machinery, etc., from the harbor to the site of this heavy cutting, it was at once apparent there was no alternative to be considered but the immediate construction of a railroad. This was begun in the summer of 1890. It extends across what had always been considered an impassable swamp, and for the first 10 miles there are but about 4 miles of hard ground. Soon after beginning heavy rains set in, and the swamp was flooded to a depth of from 1 to 4 feet. No earth for filling could be had from along the track and so all had to come from a distance, brought by train, and these conditions necessitated a reversal of the ordinary

proceeding, *i. e.*, laying the track first and making the required embankment afterward.

To accomplish this, novel methods were employed. A heavy corduroy of logs, gotten from the neighboring forest, was laid for many miles. These were rolled, floated or dragged by man power alone to the line of proposed track, and there arranged as compactly as possible. Upon them were laid longitudinal stringers, also consisting of native tree trunks—the straightest that could be found. Then came the railroad ties, resting on the stringers, and lastly the steel rails, all spiked down. Now, the cars, loaded with sand, were run out over the log embankment and there unloaded, the sand being packed into the interstices and under the ties, which were raised gradually by the workmen until the desired grade was secured. There were six miles in all of this swamp work. Except in filling the sand trains, no other power was used than that of men, and nearly always the swamp water was above knee deep and often to the waist or armpits.

The material used in grading and ballasting the roadbed was taken from the canal prism, near the harbor, and delivered along the line by trains of cars, loaded by means of a steam shovel or “navvy,” capable of delivering upon cars 1,300 cubic yards per day.

There are several places along the line, where streams and other water courses are crossed. These are spanned by pile bridges, and a powerful steam pile driver has been used in their construction. The length of road completed to date is 11 miles—the most difficult of the whole line, and seven miles remain to be completed in order to reach the “divide.” There are several miles of side track, switches, etc., already put down.

The road is equipped for construction work, and supplied with four locomotives, fifty cars, steam shovel, ballast unloader, jacks and other requisite appliances. All the cross-ties and bridge timbers are of northern pine, and charged with 16 lbs. creosote oil to the cubic foot. At the railroad terminus on the harbor is a fine wharf, 264 feet long, built in the best manner of creosoted timber, and equipped with modern steam conveniences for handling freight rapidly.

The survey for the remainder of the railroad line, extending to the San Juan River at Ochoa, has been completed; in fact, there have been two lines surveyed and profiles prepared in sufficient detail to enable a close estimation of cost. Between Lake Nicaragua and the Pacific the railroad line is also located, and everything made ready for its construction, which, it is realized, must precede the beginning, upon a large scale, of the work of canal construction itself.

In the summer of 1890 there was purchased from the American Contracting and Dredging Company the very extensive and valuable plant used so successfully on the eastern end of the Panama Canal from the year 1881 to the collapse of that enterprise in 1888. The property consisted of seven dredges, the most powerful ever built; two fine tug boats, twenty lighters, several launches and a vast quantity of tools, spare parts, materials for repair and renewals, an entire machine shop, stationary engines, pumps, etc., etc. Many of the articles are in abundance sufficient to suffice until the Nicaragua Canal can be completed. During the Autumn of 1890 this property was transferred to San Juan del Norte—

all save one of the oldest and least valuable of the dredges, which was lost at sea. Upon the arrival of this plant, portions of it were immediately equipped for work, and three of the dredges have since been in use for various periods; two upon the line of the canal proper and a third in increasing the depth of water at various points in the harbor and upon the bar. The canal line to the width of 280 feet and depth of 17 feet has been opened for 3,000 feet inland from the harbor, the material excavated being sand almost wholly. No buried wood or other obstructions to free dredging have been found. A powerful suction dredge for working upon the bar at San Juan has been constructed in Scotland for this company, and is ready to be sent to its destination.

All the engineers employed on the line have been men of known and tried ability. Those in positions of chief responsibility have had extensive practice in works of engineering construction in the United States and the tropics. All are graduates of the best technical schools. Mr. A. G. Menocal, who has been connected with the enterprise from its organization, is the Chief Engineer.

The engineers, administrative staff, surveyors, nearly all the skilled mechanics, foremen, etc., have been hired in the United States and sent out under contract for at least a year's service. The common laborers are of two classes—the natives of Central America and the negroes from the island of Jamaica. All have been housed and fed by the company, and supplied with medicine and hospital attendance free. The rate of wages paid to common laborers varies from 20 to 30 soles per month (the Colombian sole has a value of about 75 cts. gold), and it is evident from experience gained that an abundance of acclimated labor, entirely adapted to the company's needs, is readily obtainable from the localities named.

Mention has been made of a steamboat company operating a line of boats upon the San Juan River and Lake Nicaragua. As the owner of these boats held an exclusive privilege for navigating the San Juan River and Lake Nicaragua by means of steam vessels, it became necessary for this company to acquire the property referred to. This was done in the fall of 1889, and the line has since been operated in the interest of the Construction Company. The franchise is a very valuable one, aside from its bearing upon the construction of the canal.

Reference has also been frequently made to the Rio San Juan and the town and port of San Juan del Norte. The river which drains Lake Nicaragua and discharges into the Caribbean Sea has always been known by that name, but the town and port at its mouth, anciently known as San Juan de Nicaragua, and afterwards as San Juan del Norte—to distinguish it from San Juan del Sur on the Pacific coast—was re-named Grey Town by Great Britain, when that power seized the port some thirty years ago. This is the popular name now, but not recognized by the Republic. San Juan del Norte is the only correct appellation, and this in common parlance is shortened to "Del Norte," and the name of the Pacific port near Brito to "Del Sur."

The point where the canal enters the harbor is some two miles distant from Greytown, and in the autumn of 1889 the Government laid out a town site on

the shores of the harbor at the point where the canal enters it. This has been named "America," and here are located the canal headquarters.

The maps bound in this pamphlet and other illustrations will assist the reader to a better understanding of the verbal description here given.

The company has gone to its work of building the canal in a plain, unostentatious, systematic manner, and, although nearly all accomplished to date may be described as preliminary, yet a very important advance has been made. These results may be summarized as follows:

1. The completion of the final surveys for location and construction.
2. The subterranean examination of the strata requiring removal, by means of borings with the diamond drill.
3. The restoration of the harbor of San Juan del Norte to the extent of securing an easy entrance to the port for vessels of 12 feet draft.
4. The construction of extensive wharves and landing facilities.
5. The erection of permanent buildings for offices, quarters, hospitals, storehouses, shops, etc., having a floor area of an acre and three-fourths.
6. The building of a large number of temporary camps along the line for accommodation of employes.
7. The completion of a telegraph line permitting ready communication of the New York office with any part of the work.
8. The clearing of the canal line of timber for some 20 miles.
9. The completion of surveys for location and plans of construction of the railroad system, and the construction and equipment of 11 miles of this line.
10. The acquisition by purchase of the most valuable and powerful dredging plant to be found in America under one management.
11. The fitting up and operation of this plant and the opening of nearly a mile of the canal.
12. The acquirement by purchase of the valuable and exclusive franchise for the steam navigation of the San Juan River and lake, together with the extensive plant of the Nicaragua Mail Steam Navigation Company, consisting of offices, lands, steamboats, tugs, lighters, repair shops, etc., etc.
13. And, lastly, what is felt to be the most important result of all is the demonstration, secured by experience, of the salubrity of the climate, the

efficiency of labor and the sufficiency of the estimates of the chief engineer for the harbor and canal dredging and railroad work.

FINALLY, The government of Nicaragua has formally made acknowledgment of the fact that the company has fully complied with the requirement imposed by Article XLVII. of the canal grant, which provides that the work of construction shall not be considered as commenced unless two million dollars are expended in the first year.

This formal acknowledgment confirms the company's title to the concessionary rights for a term of ten years in which to complete the canal and open it for traffic.



THE DREDGES "CITY OF PARIS" AND "M. A. SLAVEN" WORKING IN THE CANAL, SHOWING EMBANKMENT THROWN UP AND R. R. TRAIN BELOW IT, LOOKING NORTH.

CHAPTER VI.

FINANCIAL ASPECTS OF THE ENTERPRISE.

Among the many advantages possessed by Nicaragua, there is one which far exceeds in value all her natural resources of mine, or field, or forest. She stands midway between the northern and southern extremities of the American continents, and the barrier she there presents to direct communication between the Atlantic and Pacific Oceans and the countries bordering upon them is the least that exists anywhere in the entire length of the mountain range, which extends from the Arctic Ocean to the Straits of Magellan. What this barrier is, and the ease with which it may be surmounted has already been described in these pages. What its importance to the commercial world amounts to remains to be considered.

As a means of transport, a continuous ocean voyage between port and port is of the greatest value to the merchant, because, other things being equal, he attains thereby the lowest cost for transportation of the commodities in which he traffics. The comparative cost for maritime and railroad transportation on long routes is as 1 to 5 when the maritime transportation is by steam, and as 1 to 9 1-2 when it is by sail. To shorten the length of a voyage is to lessen not only the cost of transportation, but also to diminish, in a proportionate degree, other expenses and risks. The operation of this principle in our own time, and since the construction of the canal at Suez, has naturally resulted in the return of commerce to one of its ancient routes—that by the Red Sea, the Isthmus of Suez and the Mediterranean. The diversion of commerce from route to route, because of risks diminished or advantages gained, is only indicative of what may certainly be anticipated as the result of opening a waterway for vessels across the American Isthmus. But there are also elemental principles, not brought into play at Suez, which will become actively operative with regard to the movement of commerce over the new route, proposed to be created for it by way of Nicaragua, and which practically multiply the importance of that route to the merchant, to an incalculable degree. What is meant can be best illustrated by reference to the development of the western portion of the United States. The entire railroad system of the country has been built up since the year 1826, when the first railroad in the State of New York, from Albany to Schenectady (17 miles), was built. In 1830 there were only 23 miles of railway constructed, and in 1832 the total number of miles in operation was but 229. Since then the growth of the system has been rapid. There exists now nearly 170,000 miles of railways equipped with 30,000 locomotives and 1,000,000 cars, carrying more than 700,000,000 tons of merchandise and 500,000,000 passengers annually. The population of the country in 1832, when there was but 229 miles of such roads, was between 13,000,000 and 14,000,000, mostly distributed along the seaboard, the borders of the great lakes and the courses of

the great rivers. To-day it amounts to 65,000,000, distributed wherever a railway will carry a man, or bring to market the product of his fields or forests, and mines; and not only is the enormous increase and spread of population over inland territory attributable to the facilities afforded for transportation, but the growth of the great cities upon the seaboard to an importance comparable with that of the great cities of Europe, is owing entirely to the facilities the railroads have afforded for interchange of commodities between all parts of the country, and between the country at large and the world. The ease with which the accumulated wealth of the country responded to the unusual demands of Europe, during the Winter and Spring of 1890 and 1891, for gold to help meet her obligations* is evidence of the profits which the merchants of the United States have acquired and accumulated in thus facilitating the transactions of trade. Such a growth of material prosperity is also conclusive indication of what may certainly be expected to repeat itself, whenever there is provided a more convenient means of communication between the eastern portion of the United States and the Pacific coast of both North and South America; for the development of the Western States and Territories is not the establishment of a new precedent, but the operation of old and well established principles, universally operative and, therefore, to be accounted for and estimated in a commercial forecast, with as great certainty as any other factor which enters into the problem. Since 1848, the date of the gold discovery, California, Oregon and Washington have grown from wild and almost unknown Territories into prosperous, powerful and important States with large and rapidly increasing populations and an annual production of the staples of trade, over and above their needs for home consumption, which demands the most favorable conditions for its transport to the markets of the world.

In 1890 the wheat product of Oregon was 12,865,000 bushels, that of Washington 8,071,000 bushels, and California produced 30,000,000 bushels. The wool clip of the same territory for the same year was estimated at 65,000,000 pounds. California alone shipped by rail in the same year 235,000,000 pounds of fruit—canned, dried and fresh—to eastern markets, and over 4,500,000 gallons of wines, brandy, etc. The commerce of San Francisco with the rest of the world amounted for the year to more than \$250,000,000. These facts indicate the development which has been attained on the Pacific coast of the United States alone, in face of the heavy cost of transportation of products by rail across the continent, or by sail around Cape Horn to their markets. Of these products the wheat, the wool, and the wines were largely marketed in Europe, and consequently went by sail around Cape Horn, a distance of 15,600 miles. The canal route will shorten that distance over one-half, to 7,600 miles.

Between New York and San Francisco the ocean route will be shortened from 15,600 miles, "around the Horn," to 4,900 miles by the canal, as against the railroad route which is about 3,300 miles. What the effect of such a saving in transportation, of time as against sail, and cost as against rail, will be upon the further development of the Pacific coast is but slightly indicated by the

*The amount of gold remitted to Europe in 1891, prior to August 1st, was \$71,888,080, and the amount returned to the United States, from the latter date to November 15, 1891, was upwards of \$25,000,000.

growth that has already been realized there, or by what has been accomplished by the construction of railroads in other parts of the United States. The present product of wheat and wine and wool indicate the development of industries naturally incident to, and which follows the growth of population and settlement of the country. The growth of other industries of similar nature and relations, though of lesser magnitude, might be mentioned, but it would only be to add evidence to what is already conclusive in that direction. There are, however, other possibilities incident to the country itself which may not be ignored. That the climate is favorable to growth of the products, of which the foregoing statistics are given, it is not necessary to say; the isothermal line of northern Virginia meets the Pacific ocean 200 miles north of the northern boundary of Washington, giving the Pacific slope a mildness of temperature especially favorable to agricultural industries; it may not, however, be out of place to speak especially of the quality of some of the products. The wheat grown on the Pacific slope has long been celebrated; its berry is large, hard and plump, and weighs considerably over sixty pounds to the bushel; the fibre of the wool is uniform, and by proper selection and care of the flocks the finest grades may be and are produced. The grapes of the more southern sections, are rich in sugar and not only yield wine, of a quality which with growing experience in the processes of treatment is steadily improving, but they also produce raisins which compete with the finest offered in the New York markets.

But in the forests and the fisheries of Western Oregon, Washington and Alaska there exists, ready to the hand of the incoming settler, an indigenous source of wealth, the value of which it is impossible to estimate. There are 20,000,000 acres of forest land and 400,000,000,000 feet of merchantable timber in western Washington alone. The trees are principally evergreen, the most valuable being the Douglas and other firs, white cedar, hemlock, spruce and white pine. The Douglas fir constitutes the largest portion of the forests, and trees 200 feet high and 10 feet in diameter are not uncommon.

The present capacity of the Puget Sound mills is 900,000,000 feet per annum. Some of these mills work up logs 120 feet long and 6 feet in diameter, and yet are not of sufficient capacity to handle much of the timber there found. A year or two ago a lumberman shipped a stick of this timber to San Francisco measuring 154 feet in length and 24 inches in thickness. The white cedar shingles made in the Puget Sound district are of such desirable quality that they bear the heavy charges of railroad transportation to markets as far east as central Ohio. The forests of Maine are denuded of spar timber, and for the last six or seven years cargoes of large sticks have frequently found their way to eastern ports, even at the cost of a voyage round Cape Horn. The Gulf States, also, already find their supply of timber rapidly diminishing, and lumber for building purposes brought from the Pacific coast will find a ready market in the Gulf ports and the West Indies so soon as it can be delivered at prices not too much enhanced by costly transportation. Thus the eastern and more densely settled portions of the States will become the convenient market for the abundant product of the now remote forests of the Pacific Coast.

The products of Alaska, as well as of Washington and Oregon, mostly

low-priced commodities furnishing a large bulk of tonnage, will be carried at less cost to eastern markets, the markets of the western coast of South America will be opened to the low-priced coals of our southwestern States, and the coasting trade now carried on with the West Indies to the extent of over 500,000 tons per annum will be extended beyond calculation. If a traffic of such magnitude has been developed between the United States and the islands of the Caribbean Sea only, what may be expected when the markets of the Pacific coast of Colombia, Mexico and Central America, of the States of Equador, Peru, Bolivia, Chile and of California are opened to the easy access of coasting vessels?

In the existing lake and and coastwise trade of the United States, steel barges carrying from 1,500 to 3,000 tons freight towed by powerful tugs are taken at low cost to market points, and there left to discharge and reload for a return voyage, while their motive power returns without delay with freight in similar barges, made ready for departure before their arrival. Thus, movement of freight is accelerated, invested capital is made to yield its largest returns, shippers profit by the possibility of lowered rates and consumers by the possibility of lowered prices. Under such conditions the traffic of the Sault Ste. Marie Canal has developed from 1,567,741 tons in 1881 to the enormous aggregate of 8,388,891 tons in 1891,* and is still increasing. And this traffic has grown up in connection with the internal trade only of a portion of the northwestern States with the East. Like results will follow similar methods, which are equally available in the waters connected by the Nicaraguan canal, and commercial enterprise will not be slow to avail itself of the unprecedented opportunity. We have already mentioned the products of the forests and fisheries of Oregon, Washington and Alaska, and the products of British Columbia; returning to the subject, the following facts will also be of interest:

The salmon pack of British Columbia, Alaska, Washington and Oregon and California amounted in 1889 to 1,683,800 cases, about 84,200 tons, valued at \$9,064,000, exceeding in quantity the pack of 1888 by 527,000 cases; 680,000 cases of the product were from Alaska, and 422,000 from British Columbia. This is a growing industry; the pack amounted in 1880 to only 679,490 cases; in ten years it has increased nearly 250 per cent. Hop growing as an industry was commenced in Oregon and Washington as recently as 1885. In 1889 the product was 70,000 bales, regularly quoted and competing in quality with other goods in the New York market. The fur seal and whale fisheries are also important industries.

The cultivation of India rubber in Central America, and on the western coast of Mexico, is already attracting attention. The increasing demand for the gum and the destruction of trees in their natural state by the reckless *huleros* or native gum gatherers, makes attention to an artificial supply for future demands of manufacture imperative; already large manufacturing corporations in this country are making plantations to meet it. The tree grows naturally in Central America and Mexico. The western coast of these countries, from the sea level to 1,800 or 2,000 feet of elevation above the sea, seems particularly favorable

*June 30th, 1890, to June 30th, 1891.

to its best development. This is an industry which will pay tribute to the canal.

But in the forests of the northwestern Pacific coast there exists material which needs only the facilities of the canal for its transportation to a favorable market to yield a tonnage, which alone will probably exceed that of all other industries combined. The wonderful growth of the lumber trade of that section, under present limitations of transportation, is an indication of the magnitude to which it will grow with the opening of new and more extended markets, by the shortening of distances to them on lines within the still waters of the temperate and torrid zones, instead of by the routes now existing through the tempestuous seas of the storm zone.

In 1886 the shipment of lumber from Oregon amounted to 6,000,000 feet, equal to 12,500 tons; in 1887, to 48,000,000 feet, equal to 100,000 tons. In 1888 the amount cut amounted to 706,985,000 feet, and the shipments abroad to 471,325,000 feet, equal to 981,925 tons, or nearly 1,000,000 tons.

The forests of Maine no longer yield the timber needed for masts and spars of large vessels. In the forests of Oregon trees grow to 12 feet diameter and 300 feet in height. The average length of a cargo of sticks taken to Boston from Puget Sound by the bark "Crapo," in 1890 was 126 feet, and their average diameter 39 inches. Sixty of these sticks were bought by a shipbuilder of Bath, Me. This fact shows how depleted the Maine forests are of spar timber. Cuba commenced the importation of lumber for building purposes around Cape Horn, but found the experiment too costly to be continued. In our Southern States the hard pine, though less desirable, is taking the place of soft pine because of advancing prices. All these demands will be met and supplied, from the Oregon and Washington lumber fields, with the opening of the canal.

What this demand and its supply will actually amount to is mere conjecture, but considering the coast-wise trade as a whole, including the growing trade in coffee, cacao and India rubber, in the mahogany, rosewood, ironwood, and other hard woods of Central America, the whale oil and the seal fisheries of the Northern Pacific, the furs of Alaska, the wheat, canned salmon and other products of British Columbia, Washington and Oregon, the spar timber and other lumber from the forests, and the return trade in coal, textile fabrics, agricultural implements, machinery, iron goods, etc., an estimate of 1,000,000 tons per annum for the amount of its addition to existing commerce, will be conceded to be none too great an allowance.

The most healthy and most attractive portions of the Spanish-American republics are those bordering on the Pacific ocean, occupying the western slopes of the mountain chain which extends north and south through both continents. This entire section of country will be brought by the canal nearer to its present markets, which are chiefly in Europe, say from 2,000 to 6,000 miles; but what is of greater importance, it will also be brought from 5,000 to 10,000 miles nearer to New York than at present and at the same time 2,700 miles, or substantially the width of the Atlantic, nearer to New York than to any European port. Such an advantage cannot fail to have the effect of developing enor-

mously the commerce between these countries and the United States, which at present is but limited.

By the facilities thus afforded for the transactions of commerce, the industries of the several countries will be stimulated and developed, and immigration, with its beneficial effects to South American shores as well as to those of California, Oregon, Washington and Alaska will follow. A great increase of population along the entire western coast of the American continents, together with the growth of commerce which will naturally accompany it, will unquestionably result from the completion of the canal; what it will actually amount to may perhaps be indicated by the instances already cited of the growth of the United States from the extension of her railroad system. To venture upon an estimate of its probable magnitude and to state it definitely in figures, would expose one, whether deservedly or not, to the charge of permitting an over-sanguine imagination, or some less excusable motive, to influence sober judgment; but in view of existing facts, no one can reasonably ignore the certainty of such a development to a material degree; and it follows that the commerce incident to it will very materially contribute to the profits of the canal. Other important incidental developments may also be expected, such as the transfer to the United States of much of the commerce of Europe with Asia in commodities which the United States can produce of equal quality and at as low a price as elsewhere, the traffic in which she is now excluded from competing for by the longer routes and correspondingly higher cost of transportation. But, aside from such possibilities, the business which already exists within what may properly be considered the radius of the canal's influence, when it shall be opened to commerce, is of a magnitude to assure financial success to the enterprise without any regard to future developments.

In this connection the first question which suggests itself to one interested in the project and the possibility of its realization is: To what distance from the canal will its attracting influence be felt? Upon the satisfactory answer of this question depends the reply to another which logically follows. At what cost will it pay to construct the canal? To the first of these questions the answer is: It will be felt so far as the charges for transit of a vessel are less than the costs saved the merchant and shipowner by the reduction in the length of her voyage.

The first and all-important advantage offered by the canal to the shipowner and the merchant, is the great reduction effected by it, in distances by ocean routes, between important commercial points. This is the primary question to be considered by any projector of a transportation scheme, and without such an advantage the scheme that possesses every other attractive feature can only result in destructive competition. What advantages the Nicaragua Canal offers in this respect will be best understood by a careful study of the table at page 76 which has been carefully compiled from data furnished by the United States Hydrographic Bureau, and may therefore be relied upon as correct.

The voyage from San Francisco around Cape Horn to Liverpool is about 15,600 miles, varying with the season. As a very large and annually increasing business in grain is transacted by this route between the ports named, the

statistics of which are well ascertained, it will afford, perhaps, the most reliable, as well as the most accessible, data upon the subject. This business at present is chiefly transacted in sailing vessels which may in course of time be changed for steamers, but as the increased speed and capacity of steamers is attended by an increased cost of original construction and of daily operation, which advantages and costs are in a great measure compensative, the conclusions deducible from present conditions, corroborated, as they are, by the practical experience of steamers now in use, may be relied upon as generally applicable.

The cost of a sailing vessel of 2,000 tons register, equipped complete, is about \$60 per ton, or say \$120,000. The annual allowance usually charged against her earnings for interest on capital (6 per cent.), insurance (8 per cent.), depreciation or amortization (10 per cent.), is 24 per cent. In order that the estimates of cost may be on the side of safety we will assume a gross charge for these items of 4 per cent. less, say an even 20 per cent; this amounts to \$66.40 per day, to which must be added, for wages and subsistence, about \$1,000 per month, or say, \$33.33 per day, making the total daily expense of such a vessel about \$100. If her crew is discharged upon arrival in port it is replaced by stevedores, so that no allowance need be made on that account. Her port charges will amount to about \$4,000 on each voyage.

The voyage from San Francisco to Liverpool, usually made in sailing vessels and around Cape Horn, will on an average occupy 120 days, and the vessel will be in port discharging and receiving cargo from 30 to 60 days. Allowing 120 days for passage and only 40 days in port, the whole voyage is estimated at 160 days, which is within the average. Freights for wheat in San Francisco fluctuate very materially, according to supply and demand. During the year 1890 they fluctuated between \$7.50 and \$10.96 per ton, the average rate being \$9.45, but most of the wheat charters in the Fall, were taken at rates varying between \$8.50 and \$9.15. It cannot be considered too high then if we take \$8.50 per ton as an established rate for freights; the figure is certainly low enough.

A vessel of 2,000 tons register will carry about 3,000 net tons of		
cargo, which at \$8.50 per ton will earn for the voyage		\$27,000 00
The expenses of the voyage, 160 days at \$100 per day,		
as above	\$16,000	
Port charges say	4,000	\$20,000 00
Leaving a net profit of		\$7,000.00

for 160 days service. This estimate of profit may be somewhat too large, inasmuch as the estimate of expenses of current voyages has been made low in order to avoid the charge of unjust discrimination in favor of the voyage by the canal.

Assuming the cargo to be entirely of wheat at 75 cents per bushel and forty bushels to the ton, its value would be \$90,000. We have thus, as the data with which to make comparison, the voyage of 160 days at an expense of \$100 per day, yielding a profit to the ship owner in freight of \$7,000 carrying a cargo worth about \$90,000.

At 120 days' passage, the 15,620 miles between ports would be traversed at

the rate of 130 miles per day, which is better than the average of sailing voyages. By use of the canal projected at Nicaragua, the distance between ports would be shortened 7,993 miles or 61 days' time which, at \$100 per day, as above, would amount to a saving in expense alone of \$6,100.

In addition to this the voyage would be made in 59 days instead of 120, which would enable the shipowner to make 3 1-2 voyages in the year instead of 2 1-4, as at present, thus increasing the earning capacity of the vessel over 55 per cent. There would also be less stress on the vessel and her rigging, sailing through quiet waters instead of by the stormy route around Cape Horn, and consequently less depreciation from wear and tear; and lower rates for insurance, because of increased safety, would necessarily follow. The annual earning capacity of such a vessel would thus be increased by the shortening of the voyages at least

To which add diminution of expenses on 3 1-2 voyages, at \$6,100 per voyage	\$11,000 21,350
---	--------------------

There would thus accrue a fund of \$32,350 over and above the previous annual earning capacity of the vessel against which to charge canal tolls at such rates as might be found practicable. There will also be an advantage to ship-masters of iron vessels in passing through the freshwater canal and lake, the value of which is important, but cannot—for lack of data—be appraised. The marine growth upon the hulls of such vessels, in tropical waters, is so great as to materially retard their speed, and so rapid, as to necessitate their "docking" at least three times a year. The change from salt water to fresh, in passing through the canal, will destroy the animal and vegetable life and at least greatly retard its accumulation. But, in addition to the advantages which the shipowner might derive from the use of this canal, the saving of interest to the merchant by the more prompt delivery of his goods, which upon each such cargo of wheat would alone amount to \$900, increasing above that amount in the proportion that the cargo becomes more valuable; the greater frequency with which, for reason of the shorter voyage, his capital would become available for use; the diminished cost of insurance which greater safety of transit would induce, and the narrowing of the risks of trade by shortening the term of transportation, are each and all potent influences with the owner and shipper of merchandise, the value of which cannot be justly arrived at except from practical experience; and it is the owner of the goods who, first considering the price demanded for service rendered, together with all contingent circumstances, ultimately determines by what means his property shall be transported to market.

The rate of \$2.50 per ton has been assumed as the probable canal toll in connection with all recent projects for transit across the American Isthmus. At this rate, and upon the basis of the facts used in the foregoing illustration, it is estimated that a saving of 2,300 miles in a voyage of 13,000 miles will be more than a sufficient inducement for shipowners to make use of the canal. That the estimate is a safe one, and applicable to steamers as well as sailing vessels, is apparent from the fact that British steamers between the ports of

Sydney and Melbourne in Australia and English ports find it advantageous to use the Suez Canal for a saving of 1,231 miles at the cost of the tolls established at Suez, which amount to about \$1.96 per ton. Upon this basis it would pay to use the Nicaragua Canal at \$2.50 tolls for a saving of considerably less than 2,000 miles in an equal voyage, say 12,000 miles. We may, then, assume that an economy of from 2,000 to 2,300 miles in a voyage is necessary to the advantageous use of the canal at a tariff of \$2.50 per ton.

That the transportation of freight on long voyages will ultimately be made by steam in preference to sail is apparent from the change which has taken place in that direction during the past decade. Such a change will not, however, materially affect the conclusions arrived at, except, perhaps, to magnify the importance of the shorter route.

It follows next in order, to consider more particularly the question of the amount of existing traffic likely to be attracted to an inter-oceanic canal across the Isthmus when opened. It has been commonly said that the attractive influence of such a canal will be felt as far as the 110th meridian of longitude, east from Greenwich. There can be very little doubt as to the correctness in general of this opinion, for there is even room for question whether it will not be felt beyond that limit. Owing to favoring winds and currents, which prevail in the Pacific, it is no unusual thing for English sailing vessels which make the outward voyage to Hong Kong or Australia by the way of Good Hope to return around Cape Horn. Such vessels are debarred from the use of the Suez Canal by the frequent shoals and the uncertain winds of the Red Sea, the length of which, 1,310 miles, is too great for economical towage; these objections do not exist as against the Nicaragua Canal, and in view of the fact but just stated, it may be expected that the attractive influence of the canal, at least so far as homeward voyages are concerned, will extend beyond the equal division of distances, which the 110th meridian is assumed to make.

The meridian, 110 degrees east from Greenwich, includes the entire coast of China with the ports of Macao, Hong Kong, Shanghai and the Island of Formosa, the Kingdom of Corea, the Empire of Japan, the Phillippine Islands, Borneo, New Guinea, Australia, Tasmania, New Zealand, and, in fact, almost all the islands of the Pacific. These points, together with the entire inhabited portion of the Pacific coast of the American continent, are brought nearer to the eastern ports of the United States by distances varying from 3,000 to 10,000 miles. But what is of still greater importance to the United States is that all of them are brought nearly the whole width of the Atlantic Ocean nearer to New York than to European ports. New York and Liverpool are now practically equi-distant from Valparaiso, Callao, Acapulco, San Francisco and all intermediate ports, but with the opening of the canal New York will be brought 2,700 miles nearer these ports than Liverpool will be; at the same time Valparaiso, on the Pacific coast of South America, is brought 1,000 miles nearer to Liverpool and other European ports than by existing routes; and points north of Valparaiso are approximated by distances varying from 1,000 to 6,000 miles.

New York is brought 1,800 miles nearer Australia, 2,700 miles nearer New

Zealand, 1,900 miles nearer Japan and 300 miles nearer Shanghai than those places are to Liverpool by the shortest routes. New Orleans has 760 miles more of advantage than New York. The eastern ports of the United States are thus placed on an advantageous basis as competitors for the commerce of those countries. These facts, aside from any comparison of new routes with the old between present markets, or of any of the conditions that attach to either, warrant the assumption that a certain portion of existing commerce will be diverted from present routes to the new, by its diversion from old markets to new ones; certainly the enterprise of American merchants will have ceased to be what it has been in the past, if such is not the result.

In view of these conditions, it will not be considered improper to claim that all the commerce existing within the limits designated, is subject to the attractive influence of a canal across the American Isthmus, although there may be a difference of opinion as to the degree to which the attraction will be felt. So much of it as already exists, or may in the future be developed, between ports on the Pacific Ocean and the eastern and gulf ports of the United States, together with that transacted between Europe and the western coasts of the American continents, Japan, etc., must sooner or later be irresistibly attracted to the canal under any tolls that are not prohibitory. It has been questioned whether all the business between Europe and the Pacific coast of South America will find it advantageous to use the canal at such tolls as may be established, inasmuch as the saving of distance to Valparaiso by steamers which pass through the "Straits" is but little over a thousand miles.

If this were all, the doubt would appear to be well founded, but with an understanding of the facts as they really exist that doubt will disappear. Nine-tenths of all this business is transacted by the Pacific Steam Navigation Company which runs its boats from Liverpool to Callao, stopping at Valparaiso and other ports *en route*. The distance via the Straits of Magellan from Liverpool to Callao, which includes Valparaiso, and is the actual length of the voyage, is about 9,960 miles. The distance, making the voyage via the Nicaragua Canal to Valparaiso, as a terminus, would be 7,734 miles, without reference to calling at the intermediate ports, which would add about the same mileage in either case, showing a saving of at least 2,226 miles on the voyage. For sailing vessels, which cannot avail themselves of the shorter route by the "Straits," but must double Cape Horn in their passage, Valparaiso itself, independently of Callao, will be within the zone of attraction.

Of the commerce between Europe and other ports of the Pacific, as for instance with Hong Kong, Shanghai, the Straits Settlements, Japan, Australia, New Zealand, Tasmania, etc., a very large proportion is carried in sailing vessels, to which the use of the canal would undoubtedly prove advantageous; of the rest, some portion, such as is carried by vessels with auxiliary steam power, may also find advantage, because of favoring winds and currents, in its use on homeward bound voyages.

In 1890, the wheat and flour fleet from San Francisco carried 780,000 tons of wheat and flour to Europe. Chile and Bolivia sent about 860,000 tons of nitrates and 75,000 tons of wheat, and Peru sent about 80,000 tons of nitrates

and guano. In the same year the United States sent 714,150 tons of illuminating oil, mostly in sailing vessels from Atlantic ports, to foreign ports on the Pacific, in addition to 37,000 tons shipped to San Francisco principally by rail. California also exported in the same year from the port of San Francisco alone 148,446,150 pounds of canned and dried fruits, including raisins; 1,625,867 cases of canned salmon; 4,500,000 gallons of wines and brandy; 5,734,120 pounds of hops, and 22,662,000 pounds of wool, fully 90 per cent. of all which was transported to eastern ports of the United States or to Europe; the great bulk of it paid the cost of railroad transportation. Portland, Seattle, Tacoma and other cities were also large exporters of like commodities, and large quantities of shingles were shipped from Puget Sound. All of these places were at the same time large importers of provisions from the eastern States by rail. This business, including the traffic around Cape Horn and across the Isthmus of Panama between ports of the United States and ports of British Columbia with eastern ports of the United States cannot be estimated at less than 500,000 tons annually, and is probably much in excess of that amount.

Statistics of the *tonnage* of traffic, excepting in particular commodities at particular points, such as above instanced, are not generally reliable; it is, therefore, convenient and more satisfactory to base an estimate of bulk upon the actual values of exports and imports as ascertained from the customs reports of different countries taken at a liberal average valuation for the ton. Upon such an estimate carefully made, it appears that the tonnage of the traffic (referred to on page 68) already existing between foreign ports of the Pacific Ocean and the eastern and Gulf ports of the United States, together with that between Europe and the western coast of the American continents and Japan, etc., excepting that in the commodities but just cited, amounts to 4,150,000 tons.

On a similar estimate, the commerce between Europe and more remote ports of the Pacific (referred to on page 68), together with other traffic which must be considered as only partially tributary amounts in the aggregate to 5,600,000 tons. This item, however, can only be considered as contingently tributary to the canal—that is to say, so far as it may be influenced by conditions already referred to; what the proportion which will be attracted may be, it is impossible to say, but we shall not be considered as claiming too much if we estimate it at 1,000,000 tons only. Summarizing the foregoing we have the following result:

San Francisco wheat and flour fleet, p. 68,	780,000 tons
Chile nitrate shipments, p. 68,	860,000 "
Chile wheat shipments, p. 68,	75,000 "
Peru nitrates and guano, p. 68,	80,000 "
U. S. illuminating oil to Pacific ports, p. 69,	714,150 "
Traffic around Cape Horn by Isthmus and by railway, etc.,	
between U. S. ports, etc., domestic commodities, p. 69,	500,000 "
General traffic entirely tributary, p. 69,	4,150,000 "
Proportion of general traffic only contingently tributary, p. 69,	1,000,000 "
Total	8,159,150 tons*

* For estimate of Tonnage existing in 1884, by M. Amédée Marteau, see Appendix pp. 62 and 63.

This total may be regarded as the tonnage now existing, which, if transit by the canal were possible to-day, would naturally seek that route and pay its tolls in preference to following those which are at present in use.

Statistics show the normal growth of commerce to be at the ratio of about 1 per cent. per annum. Assuming that the canal will be completed and ready for use by the year 1897, and that the statistics which we have used are for the year 1890, we must add 7 per cent. for natural growth, say 571,140 tons, making 8,730,290 tons the aggregate of freight existing in 1897, for which the canal, if open to traffic, will afford the most convenient route for transportation, but this is only allowing for a normal growth of commerce, and for reasons worthy of consideration, which have already been indicated, growth in greater proportion than normal is to be expected, whenever the near prospect of the canal's completion shall give such assurances of its availability as to warrant merchants in venturing upon new enterprises. With the opening of the canal not only will a new route be provided, but new fields will be opened to commerce by the more advantageous provisions for its transaction. If we add for this development 1,000,000 tons as estimated on page 63 the aggregate of the traffic apparent, from which the canal may be expected to derive its business and its revenue, amounts to 9,730,290 tons, not to speak of those unforeseen and unexpected developments, of which the commerce of all new countries has always been prolific, whenever increased facilities have afforded more favorable opportunity for an exploitation of the natural resources of the region. In this respect the opportunity of the Nicaragua Canal is unique. The countries chiefly brought into nearer contact by the Suez Canal are old and densely populated. Europe with its population of 101 to the square mile, and Asia with a population of 57 to the mile, or, to speak more precisely, England, France and Belgium, as parts of Europe, and India and China, as parts of Asia, have very few new or untried resources yet remaining open for development. On the other hand, by the Nicaraguan Canal, North America with a population of 14 to the mile chiefly east of the Rocky Mountains, South America with a population of 5 to the mile, and Australia with a population of only 1 4-10 to the mile, all of them the abodes of vigorous, rapidly increasing and enterprising peoples, with as yet many only partially developed resources, the magnitude and value of which are already shown to be almost incalculable by such essays as have been possible under existing circumstances, are brought nearer to each other and into closer connection with Europe, by a channel of communication through a country unsurpassed in its natural attractions, equally rich in its resources, and of a climate exceptionally healthy, which from its natural beauties must, when facilities for travel are afforded, become a pleasure resort for travelers from all parts of the world. It would seem that if the conditions for an unprecedented growth of population, commerce and material prosperity ever existed anywhere, they exist here to a degree never before exceeded. The great success of the canal at Suez, not only in respect of its returns to those who ventured their capital in its construction, but more especially in the realization of all the advantages to commerce which were predicted of it by its projectors, is an assurance that the Nicaragua Canal will find commerce ready

to avail itself at once of its advantages, instead of waiting until the more venturesome spirits shall have tried them and proved their value. Because of the grand success at Suez, the advantages of canal transit have ceased to be the subject of experiment, and have become demonstrated facts. The business of the Nicaraguan Canal, therefore, will not be of small beginnings and slow growth, but will at once assume a magnitude commensurate with the opportunity; and it is not unreasonable to expect, that of the 9,730,290 tons estimated as within the zone of attraction, at least two-thirds, or say 6,500,000 tons, will seek the new route for transit as early as within the second year of its availability.

If the canal tolls be fixed at \$2.50 per ton, this amount of traffic (6,500,000 tons) will yield a gross revenue of \$16,250,000.

The cost of maintenance and operation of the canal, after its completion, cannot be large. The route is made up principally of broad stretches of water with natural banks, or of cuttings through solid rock which once made will be permanent; and there are no sands drifting from widespread desert plains, as at Suez, to fill its channel continually and make necessary large and unceasing expenses for dredging. The cost of maintenance must, from the nature of things, therefore be moderate. The operation of the lock of the Sault Ste. Marie canal, which passed nearly 7,500,000 tons in the season of 1890-91, together with all other expenses of that canal for that year, amounted to \$45,417. Allowing \$50,000 for each of the six locks of the Nicaraguan Canal for operating alone, and making a similarly liberal allowance for maintenance, administration and all other expenses, the total annual cost cannot exceed \$1,500,000, which, on an annual traffic of 6,500,000 tons at the rate of toll suggested, shows a net revenue of \$14,750,000, or 5 per cent. on a total capitalization of \$295,000,000, to be realized upon the attainment by the enterprise, of such a condition of advancement as will afford opportunity for demonstration of its capabilities.

What the growth of its traffic and revenues may be from this point is, of course, a matter of conjecture, but in view of all the contingent conditions, it cannot fail to be large and rapid, and it is not unreasonable to believe, that although the canal has been projected with a view to the accommodation of a large traffic, its capacity, before many years shall have passed, will be taxed to the utmost.

In May, 1889, the estimates, made by Mr. Menocal, of the cost of construction were submitted to the investigation of an independent committee of eminent engineers, and made by them the subject of a careful report, the full text of which will be found in the Appendix.* The following comparative statement will give a summary of the estimates of the chief engineer and of the consulting engineers:

*See Appendix No. 8.

	Menocal.	Committee.
Cost of Eastern Division	\$23,686,048	\$34,649,805
San Francisco Division	5,103,318	5,411,551
Lake and River Division	5,692,557	6,623,663
Western Division	17,525,417	20,231,289
Surveys, hospitals, contingencies, etc	13,016,836	6,250,000
Further allowance		14,033,262
	<hr/>	<hr/>
	\$65,084,176	\$87,799,570
To these figures add for interest during construction	15,000,000	20,000,000
	<hr/>	<hr/>
Making total cost	\$80,084,176	\$107,799,570
Five per cent interest thereon	4,042,083	5,389,979
Estimated net earnings on 6,500,000 tons	14,750,000	14,750,000

In addition to the many sources of revenue already indicated, the value of which may in some measure be estimated, another is shortly to be added, concerning which but few data exist whereon to formulate an opinion of its importance. The projected Russian railway, from the heart of that great empire to the port of Vladivostock on the Sea of Japan, will bring into close commercial relations with the United States, all of Asiatic Russia and much of the interior of Central Asia now practically inaccessible to commerce. The lower valley of the Amur, before that river turns northward to its *debouchement* into the sea of Ochotsk, is said to possess an excellent climate, an exceptionally fertile soil, and to be especially adapted to wheat growing. The rigors of the climate of Siberia are generally considered as characteristic of its entire territory; as a fact, the climate of the southern provinces is said to compare favorably with that of the central parts of Europe. Such portions of the country are, therefore, likely to attract wide attention and great development with the advent of the railroad; but, however that may be, it is a fact that much of the present population of this widely extended territory is primitive and agricultural, and is likely to continue so under the most favorable conditions of growth. Ready access to it means the exchange of textile fabrics, farming implements and machinery of all kinds; the products of the looms, the workshops and forges of the United States, or of such other manufacturing nation as shall furnish the most advantageous market for its commodities. This business, too, whoever may transact it, will pay its proportion of tribute to the canal. At the same time the trade with Corea may be expected to assume important proportions. In 1884 the total value of the exports and imports of the last named country amounted to \$1,408,037 only. In 1889 it amounted to \$4,611,656, an increase of more than 227 per cent., or at the ratio of more than 25 per cent. for each successive year.

The commerce of Japan, although already of a considerable magnitude, it is to be remembered, is as yet in its infancy, and therefore susceptible of development in a ratio more than normal; of this no account has been taken in the foregoing estimate. As a fact, the commerce of that empire has doubled in the last five years, and its manufacturers are now commencing to buy cotton of us, for

their looms. Japan has a population of 40,000,000, and its people are intelligent, enterprising and progressive. In 1889 its commerce amounted to about \$136,000,000 for the year, or say \$3.40 per capita. The commerce of the United States, as compared with its population, amounts to over \$25.00 per capita. To equal one-half this ratio the commerce of Japan must increase to fourfold its present magnitude.

In whatever direction attention is turned, the substantial elements of an enormous and unprecedented commercial development, in connection with the opening of the Nicaragua Canal, are apparent to such a degree as to make an estimate of results based thereon seem fabulous, and for that reason to be avoided. Enough has been shown to prove that the canal will have an abundant business, from the day when a vessel may pass through it from ocean to ocean, to pay interest on all of the capital ventured in its construction, and to richly reward its projectors. The canal is, however, to be considered in other aspects than that of its relations to commerce or as a remunerative investment to capitalists.

In this connection, the views of President Arthur, expressed in his message of December 10, 1884, wherewith he transmitted to Congress for its consideration the treaty negotiated by the United States with Nicaragua concerning a canal across her territory, command attention. He says:

"The establishment of water communication between the Atlantic and Pacific coasts of the Union is a necessity, the accomplishment of which, however, within the territory of the United States is a physical impossibility. While the enterprise of our citizens has responded to the duty of creating means of speedy transit by rail between the two oceans, these great achievements are inadequate to supply a most important requisite of national union and prosperity. For all maritime purposes the States upon the Pacific are more distant from those upon the Atlantic than if separated by either ocean alone. Europe and Africa are nearer to New York, and Asia is nearer to California than are those two great States to each other by sea. Weeks of steam voyage, or months under sail, are consumed in the passage around the Horn, with the disadvantage of traversing tempestuous waters or risking the navigation of the Straits of Magellan. A nation like ours cannot rest satisfied with such a separation of its mutually dependent members. We possess an ocean border of considerably over 10,000 miles on the Atlantic and Gulf of Mexico, and including Alaska, of some 10,000 miles on the Pacific. Within a generation the western coast has developed into an empire with a large and rapidly growing population, with vast but partially developed resources. At the present rate of increase, the end of the century will see us a commonwealth of, perhaps, nearly 100,000,000 inhabitants, of which the West should have a considerably larger and richer proportion than now."

Among other mention, the President briefly adverts to the past efforts to find a practicable route for a ship canal across the Isthmus between the two oceans, all of which, with a single exception, have resulted in the discovery of insuperable obstacles to the building of a profitable inter-oceanic canal, the exception being that of the route across Nicaragua. Further on he says:

"From a purely commercial point of view the completion of such a waterway opens a most favorable prospect for the future of our country. The nations of the Pacific coast of South America will, by its means, be brought into closer connection with our Gulf States. The relation of those American countries to the United States is that of a natural market from which the want of direct communication has hitherto practically excluded us. By piercing the Isthmus the heretofore insuperable obstacles of time, sea and distance disappear, and our vessels and productions will enter upon the world's competitive field with a decided advantage, of which they will avail themselves. When to this is joined the large coasting trade between the Atlantic and Pacific States which must necessarily spring up, it is evident that this canal affords even alone an efficient means of restoring our flag to its former place on the seas. Such a domestic coasting trade would arise immediately, for even the fishing vessels of both sea-boards, which now lie idle in the winter months, could then profitably carry goods between the eastern and western States."

"The political effect of the canal will be to unite closer the States now depending upon railway corporations for all commercial and personal intercourse, and it will not only cheapen the cost of transportation, but will free individuals from the possibility of unjust discriminations. It will bring European grain markets of demand within easy distance of our Pacific, and will give to the manufacturers of the Atlantic sea-board economical access to the cities of China, thus breaking down the barrier which separates the principal manufacturing centres of the United States from the markets of the vast population of Asia, and placing the Eastern States of the Union, for all purposes of trade, midway between Europe and Asia."

Still another aspect calls for passing attention. In a strategic point of view the canal will be of greater value to the United States than is Suez to Great Britain. By the Suez Canal the Indian domain of Great Britain is approximated to the seat of Government 3,600 miles in a distance of 11,600, which is the length of the voyage to Calcutta by the way of Cape of Good Hope. Upon the opening of the Nicaragua Canal the distance between the naval stations of the United States, on the Gulf of Mexico, and San Francisco, on the Pacific coast, will be reduced to 4,150 miles, as against 13,530, the length of the voyage at present by the Straits of Magellan, a saving of 9,400 miles. Assuming that in case of necessity, a vessel would steam not less than 350 miles a day, the saving of time between Great Britain and Calcutta by Suez is about 10 1-2 days; between the eastern ports of the United States and San Francisco by Nicaragua it will be 26 3-4 days, and the time required for transit from any Gulf station to the Pacific Ocean will not exceed five days. The time required for transit between Great Britain and India, on the same basis, is 20 1-2 days.

In this connection, the remark of President Hayes, made in his message of March 8, 1880, is pertinent:

"An inter-oceanic canal across the American Isthmus will essentially change the geographical relations between the Atlantic and Pacific coasts of the United States, and between the United States and the rest of the world. It will be the

great ocean thoroughfare between the Atlantic and Pacific shores and virtually a part of the coast line of the United States. Our mere commercial interest in it is greater than that of all other countries, while its relation to our power and our prosperity as a nation, to our means of defense, our unity, peace and safety are matters of paramount importance to the people of the United States."

**TABLE OF DISTANCES, IN NAUTICAL MILES, BETWEEN COMMERCIAL PORTS OF THE WORLD, AND DISTANCES
SAVED BY THE NICARAGUA CANAL.**

COMPILED FROM DATA FURNISHED BY THE UNITED STATES HYDROGRAPHIC OFFICE. LENGTH OF SAILING ROUTES, APPROXIMATE ONLY.

BETWEEN	Around Cape Horn for Sailing Vessels.	Via Magellan for Full Powered Steam Vessels.	Via Cape of Good Hope.	Via Nicaragua Canal.	Advantage over Sail- ing Route.	Advantage over Steam Route.	BETWEEN	Around Cape Horn for Sailing Vessels.	Via Magellan for Full Powered Steam Vessels.	Via Cape of Good Hope.	Via Nicaragua Canal.	Advantage over Sail- ing Route.	Advantage over Steam Route.
New York and San Francisco.	15,060	13,174		4,907	10,753	8,267	New Orleans and San Francisco	16,000	13,539		4,147	11,553	9,392
Puget Sound.	13,935	13,935		5,665		8,270	Acapulco.	11,920	11,920		2,285		9,635
Sitka.	14,439	14,439		6,177		8,262	Mazatlan.	12,402	12,402		2,915		9,487
Bering Straits.	15,705	15,705		7,402		8,303	Callao.	10,005	10,005		2,984		7,021
Acapulco.	11,555	11,555		3,045		8,510	Valparaiso.	8,805	8,805		4,254		4,551
Mazatlan.	12,037	12,037		3,675		8,362	Liverpool and San Francisco.	15,620	13,494		7,627		5,867
Hong Kong.			13,750	10,692	3,058		Acapulco.	11,875	11,875		5,765		6,110
Yokohama.			15,217	9,237	5,990		Mazatlan.	12,357	12,357		6,395		5,962
Melbourne.	13,760	12,860	12,830	9,862	3,898	2,998	Auckland.	12,130	11,919	13,357	11,182	948	737
Auckland, N.Z.	12,600	11,599	8,462	4,138	3,137		Guayaquil.	10,620	10,620		5,947		4,673
Honolulu, S. I.	15,480	13,290	14,069	6,417	7,063	6,873	Callao.	9,960	9,960		6,464		3,496
Callao.		9,640	3,744			5,896	Valparaiso.	9,386	8,760		7,784		1,026
Guayaquil.		10,300	3,227			7,073	Honolulu.	13,610	13,610		9,137		4,473
Valparaiso.	9,420	8,440	5,014		4,406	3,426	Yokohama.			14,505	11,947		2,558

Length of Canal, (in nautical miles).....	147	Western Port of Canal to San Francisco.....	2,700
New York to Eastern Port of Canal.....	2,000	Portland.....	3,345
Liverpool.....	4,780	Puget Sound.....	3,468
Hamburg.....	5,137	Valparaiso.....	2,907
Havre.....	4,691	Callao.....	1,537
New Orleans.....	1,300	Yokohama.....	7,090

• APPENDICES •

APPENDIX I.

UNITED STATES CHARTER OF THE MARITIME CANAL COMPANY OF NICARAGUA.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Frederick Billings, Charles P. Daly, Daniel Ammen, Francis A. Stout, Horace L. Hotchkiss, Edward F. Beale, Hiram Hitchcock, C. Ridgley Goodwin, A. C. Cheney, J. F. O'Shaughnessy, H. C. Taylor, J. W. Miller, A. S. Crowninshield, A. G. Menocal, Charles H. Stebbins, T. Harrison Garrett, Jules Aldigé, R. A. Lancaster, Alfred E. Mills, Gustav E. Kissell, Horace Fairbanks, George H. Robinson, Alfred B. Darling, Joseph E. McDonald, James Roosevelt, Christian Devries, Frederick F. Thompson, Henry A. Parr, and such other persons as may be associated with them and their successors are hereby constituted and created a body corporate and politic in deed and in law, by the name, style and title of "The Maritime Canal Company of Nicaragua," for the construction, equipment, management and operation of a ship-canal from the Atlantic to the Pacific Ocean either entirely through the territory of the Republic of Nicaragua or through Nicaragua and in part through the territory of the Republic of Costa Rica with such collateral, connecting or cross canals as may be necessary to connect therewith, and to exercise such other powers as have been conferred by the Government of Nicaragua by the concession of that Republic to the Nicaragua Canal Association, through Mr. A. G. Menocal, its representative, and dated the twenty-third day of March, anno Domini eighteen hundred and eighty-seven, and finally approved by the legislative and executive authority of the Republic on the twentieth, twenty-third, and twenty-fourth days of April, anno Domini eighteen hundred and eighty-seven, and such powers as the Republic of Costa Rica may confer of the same kind as those named in said concession; and the said Maritime Canal Company of Nicaragua, by that name shall have perpetual succession, may sue and be sued, plead and impleaded, defend and be defended in all courts of law and equity within the United States; may make and have a common seal; and shall have and possess the rights, powers and privileges usually possessed by similar companies. It may receive, purchase, hold and convey such real and personal estate, property and rights of property, or concessionary rights as may be necessary to carry into effect the purposes of this act; may issue stock to the amount of the just value of such estate, property, and rights, and for work and labor done or materials provided in the execution of the work of constructing said ship-canal; and the stock issued for these purposes shall be deemed paid-up stock and shall not be liable to any further calls or assessments; may do all lawful things to secure the full enjoyment of the powers, privileges, rights, benefits and grants contained in any canal concession so made by the Republic of Nicaragua or to be made by the Republic of Costa Rica, as aforesaid; and to aid in the construction of said canal and to carry out the purposes of this act the said Maritime Canal Company of Nicaragua is hereby authorized to issue its bonds, and to secure the same by mortgage on its property and rights of property of all kinds and descriptions, real, personal and mixed, including its franchise to be a corporation. The principal office of said corporation shall be in the city of New York, and all legal process may be served upon the person who may at the time be in charge of said office or upon the attorney of said company, whose name and address shall be certified by the president of the company, and such certificate shall be filed in the office of the Secretary of State of the United States. *Provided, however,* That nothing in this act contained

shall be so construed as to commit the United States to any pecuniary liability whatever for or on account of said company, nor shall the United States be held in anywise liable or responsible in any form or by any implication for any debt or liability in any form which said company may incur, nor be held as guaranteeing any engagement or contract of said company, or as having assumed, by virtue of this act, any responsibility for the acts or proceedings of said company in any foreign country, or contracts or engagements entered into in the United States.

SEC. 2. That the capital stock of said company shall consist of not less than one million shares of one hundred dollars each, with the right to increase the capital stock to two million shares of one hundred dollars each, upon the vote of two-thirds of the stock of said company at any time outstanding, which shares shall in all respects be deemed personal property and shall be transferable in such manner as the by-laws of said corporation may provide. Five incorporators who shall be chosen by a majority of the number from those named in this act, shall have power to open books of subscription to the capital stock of said company in the city of New York, and at such other places in the United States, Nicaragua, or elsewhere, as they may designate, who shall receive all subscriptions for stock; and no stock shall be transferable except upon the books of the company provided for that purpose. The said incorporators shall give thirty days' notice of the time and place of the opening of said books, by publication in one daily newspaper in New York City, and one newspaper in Managua, Nicaragua, and one in San José, Costa Rica, if the said canal should be in part in the territory of that Republic. Sixty days' previous notice shall be given of the payment required of the time and place of payment by publication in one daily newspaper in the city of New York and in one newspaper in Managua, Nicaragua, and one in San José, Costa Rica, if the said canal should be in part in the territory of that Republic, and in case any stockholder shall neglect or refuse to pay, in pursuance of such notice, the stock held by him may be sold to the highest bidder for cash, according to the regulations to be made therefor in the by-laws of said company. The directors hereinafter provided for may adopt regulations and by-laws not inconsistent with the provisions of this act. All shares, stocks, bonds, certificates or other securities which the company may issue to raise the corporate capital shall be executed and issued at the principal office in the city of New York.

SEC. 3. That no certificates for stock, except as otherwise provided in this act, shall be issued till at least ten per cent. of the par value thereof shall be fully paid for in money, and such money deposited in the treasury of said company; and there shall be at least \$1,000,000 in money paid on such subscriptions into the treasury of said company within one year from the passage of this act; and said company is hereby prohibited from returning or repaying any part of the money so paid. No part of the capital stock paid in shall be at any time withdrawn or returned to the stockholders, or in any manner diverted from the proper uses of the corporation. Any violation of the provisions of this section shall subject the charter to forfeiture.

SEC. 4. That the affairs of the said company shall be managed by a board of directors, fifteen in number, who shall hold their office for three years and until their successors are duly chosen and qualified, and a majority of whom shall be citizens and residents of the United States.

At the first election five shall be chosen by the stockholders for one year, five for two years, and five for three years, and at each annual election thereafter five shall be chosen by the stockholders for three years. The said board shall elect from its number a president, who shall be a citizen and resident of the United States, and one or more vice-presidents of the company, who shall also be citizens and residents of the United States, who shall hold office for such terms as the by-laws of said board may provide, and until their successors are duly elected and shall have qualified.

SEC. 5. That for the management and disposition of the stock, property, estate and effects of the said company, the board of directors may make such by-laws, rules, and regulation as may conform to the authority granted in such canal concessions, and not be inconsistent with this act, of the laws of the United States, or the existing treaty stipu-

lations of the United States with the Government of Nicaragua or of Costa Rica, if the said canal should be in part in the territory of that Republic; and may fix the time for election of directors, and in case of vacancy in said board, caused by death, resignation, or otherwise, may fill the same. No person shall be a director who is not a stockholder, and any one ceasing to be a stockholder shall cease to be a director. All meetings of stockholders shall be held at the office of the company in the city of New York, and at least one such meeting shall be held in each year; but failure to elect directors on the day appointed by said laws shall not be deemed to dissolve said company, but such election may be holden on any day appointed thereafter by the directors, first giving thirty days' notice thereof in manner aforesaid. The directors, of whom eight, including the president, shall be a quorum, shall have full power touching the election or appointment of all officers of the company, and said officers shall hold office at the will and pleasure of said board.

SEC. 6. Said company shall make a report on the first Monday of December in each year, to the Secretary of the Interior, which shall be duly verified on oath by the President and Secretary thereof, giving such detailed statement of its affairs and of its assets and liabilities as may be required by the Secretary of the Interior, and any wilfully false statement so made shall be deemed perjury and punishable as such. And it shall be the duty of the Secretary of the Interior to require such annual statement and to prescribe the form thereof and the particulars to be given thereby.

SEC. 7. Nothing in this act contained shall be deemed or construed to in any wise restrict or impair any right of the United States under any treaty in force with the Republic of Nicaragua.

SEC. 8. That Congress shall at all times have the power to alter, amend, or repeal this act, when in its judgment the public good may so require. This act shall expire and be of no force or effect at the end of three years unless the construction of said canal shall be commenced and prosecuted in good faith within that time.

Approved February 20th, 1889.

APPENDIX II.

CONCESSIONS AND DECREES OF THE REPUBLIC OF NICARAGUA TO THE NICARAGUA CANAL ASSOCIATION.

The President of the Republic to the Inhabitants thereof:

KNOW YE That Congress has ordered as follows:

The Senate and Chamber of Deputies of the Republic of Nicaragua do hereby

DECREE.

ONLY ARTICLE.—The contract for a maritime inter-oceanic canal entered into the 23d of March, ult., between Dr. Adan Cárdenas, commissioned especially by the supreme government, and Mr. A. G. Menocal, member and representative of the Nicaragua Canal Association organized in New York, is hereby ratified. This contract shall be a law of the Republic if Mr. Menocal accepts it as soon as he be notified, with the following modifications and upon the following terms:

"The undersigned, Adan Cárdenas, Commissioner of the Government of the Republic, party of the first part, and Aniceto G. Menocal, representative of the Nicaragua Canal Association, party of the second part, both having sufficient powers, have entered into the following contract for the excavation of an inter-oceanic canal through the territory of Nicaragua.

ARTICLE I.

The Republic of Nicaragua grants to the aforesaid Nicaragua Canal Association, and Mr. A. G. Menocal, representative of the said association, accepts on its behalf, for the purposes set forth in Article VII., the exclusive privilege to excavate and operate a maritime canal across its territory, between the Atlantic and Pacific Oceans.

ARTICLE II.

The canal shall be of sufficient dimensions for the free and commodious passage of vessels of the same size as the large steamers used for ocean navigation in Europe and America, provided that no locks used in said work shall be less than five hundred and fifty (550) feet in length and thirty feet in depth.

ARTICLE III.

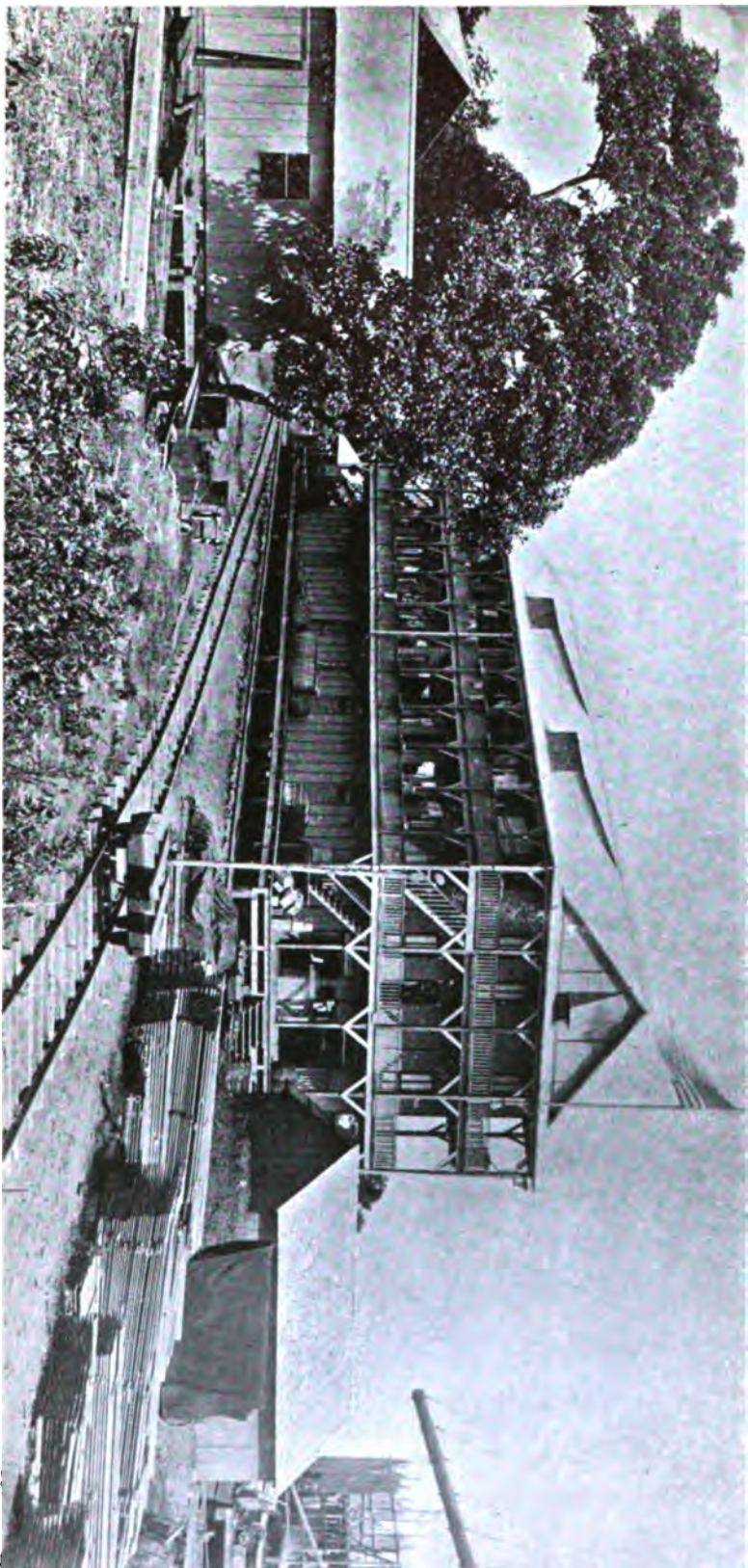
The State declares this work to be one of public utility.

ARTICLE IV.

The duration of the present privilege shall be for ninety-nine (99) years, to be counted from the day the canal shall be opened to universal traffic. During the aforesaid period the company shall have the right to construct and operate a railway along the whole extent of the canal, or those parts of the same that may be considered convenient for the better service and operation of the said work.

ARTICLE V.

The State binds itself not to make any subsequent concession for the opening of a canal between the two oceans during the term of the present concession, and also to abstain from granting a concession for a railroad, such as might compete with the canal for the



STOREHOUSE AND QUARTERS AT LA FE

transportation of merchandise, during the same period; but nothing in this article shall prevent the Government of Nicaragua from constructing or permitting the construction of such railways as it may deem advisable for commerce and internal traffic. Said government also to have the right to construct or permit the construction of an inter-oceanic railway if, in course of time, it be demonstrated that the canal is not sufficient to satisfy the demands of the traffic of all nations.

The grantee company shall have the right to establish such telegraph lines as it may deem necessary for the construction, management and operation of the canal. The government shall have the right to occupy these lines for the public service without any remuneration to the company.

ARTICLE VI.

The Government of the Republic declares during the term of this concession the ports at each extremity of the canal, and the canal itself, from sea to sea to be neutral, and that consequently the transit through the canal in case of war between two powers, or between one or more and Nicaragua, shall not be interrupted for such cause; and that merchant vessels and individuals of all nations of the world may freely enter the ports and pass through the canal without molestation or detention.

In general, all vessels may pass through the canal freely, without distinction, exclusion or preference of persons or nationality, provided they pay the dues and observe the regulations established by the grantee company, for the use of the said canal and its dependencies. The transit of foreign troops and vessels of war will be subjected to the prescriptions relating to the same established by treaties between Nicaragua and other powers, or by international law. But entrance to the canal will be vigorously prohibited to vessels of war of such powers as may be at war with Nicaragua or with any other of the Central American Republics.

Nicaragua will endeavor to obtain from the powers that are to guarantee the neutrality, that in the treaties that shall be made for that purpose, they shall agree also to guarantee a zone of land parallel to the canal and also a maritime zone in both oceans, the dimensions of which will be determined in such treaties.

ARTICLE VII.

This present agreement, with all its charges and advantages, shall be the object of a company of execution in agreement with Articles I., X., and those following thereafter.

Said company shall be the grantee, and whenever said name is used, in this present contract, reference is made to it.

ARTICLE VIII.

The present concession is transferable only to such company of execution as shall be organized by the Nicaragua Canal Association, and in no case to governments or to foreign public powers. Nor shall the company cede to any foreign government any part of the lands granted to it by this contract; but it may make transfers to private parties under the same restriction.

The Republic of Nicaragua cannot transfer its rights or shares by selling them to any government.

ARTICLE IX.

The people of all nations shall be invited to contribute the necessary capital to the enterprise, and it shall be sufficient for the fulfillment of this requirement to publish an advertisement for thirty (30) consecutive days in one of the principal daily papers of each of the cities, New York, London and Paris.

The capital stock of the final company shall be composed of shares, bonds or obligations of any other kind, in such proportion as it may deem convenient. The issue and transfer of these obligations shall be exempt from stamp dues, and from any other imposts or taxes established or that may be hereafter established in the Republic.

Of the capital with which the company shall organize, and which it proposes to dis-

tribute among the different countries interested in the enterprise, there shall be reserved at least five (5) per cent. for the Central American Governments and citizens that may desire to subscribe.

As soon as the company is ready to open subscription books it shall advise the Government of Nicaragua, which will invite the other governments, and through them private parties, to subscribe. All such shares not taken within six months following the date on which the government shall have been advised of that circumstance, shall remain subject to the free disposition of the company.

ARTICLE X.

The company shall be organized in the manner and under the conditions generally adopted for such companies. Its principal office shall be in New York, or where it may be deemed most convenient, and it may have branch offices in the different countries of Europe and America, where it may consider it expedient.

Its name shall be the "Maritime Canal Company of Nicaragua," and its Board of Directors shall be composed of persons, one-half at least, of them, shall be chosen from the promoters who may yet preserve their quality as such.

ARTICLE XI.

The Government of Nicaragua in its character of shareholder in the company of execution, as hereinafter provided, shall have the perpetual right of naming one director, who shall be an integral part of the board of directors of the company, with all the rights, privileges and advantages conferred upon them by the statutes of the company and the laws of the country under which it shall organize.

The government shall also have the right in its aforesaid capacity of shareholder to take part in such elections as the company may hold.

ARTICLE XII.

The company is bound to keep a representative in Nicaragua vested with all powers necessary for the proper conduct of the service and for the transaction of its business with the government.

ARTICLE XIII.

The canal will follow the valley of the River San Juan to Lake Nicaragua, through which will be designated the most convenient route for communication with the Pacific Ocean. In any event the company shall have the most ample freedom to select the route which it considers most convenient between the two oceans for the excavation of the canal and its dependencies and its ports, particularly those serving for entrance and exit on both oceans. The company shall have the same liberty to adopt the route which may be deemed most advantageous and economical for the construction of the canal, after the final survey by a commission of competent engineers.

However, should the company, after the survey of the River San Juan, find it necessary to abandon, in any place, the bed of the river, and cut a lateral canal, the government of Nicaragua reserves the right of requiring from the company the duty of establishing a communication between the part of San Juan not used for canal purposes, and the dividing level of the canal, by means of a lock, or a series of locks, suitable for the navigation of ships of six feet draft. As soon as the final plans are adopted and laid before the government, it shall notify the company within one month after their receipt whether or not they meet with its approval, in order that the company may proceed in accordance therewith. It is understood that this duty does not in any manner compel the company to place or to maintain in navigable condition for small craft the lower part of the river which these locks may be intended to place in communication with the canal.

ARTICLE XIV.

Within three years, to be counted from the commencement of the work upon the Inter-oceanic Canal, the company shall, at its own expense, construct a navigable canal be-

tween Lake Managua and the navigable part of the Tipitapa river, near Pasquier, of sufficient dimensions to admit of the free passage of vessels drawing six feet and of 150 feet in length. When completed, this canal shall be taken possession of by the Government of Nicaragua, and will be, after that date, the property of the Republic which, by virtue of its ownership, shall be bound to bear all expenses required in the future for the service, maintenance, repair and operation of the canal. But the company shall have the right to make use of it for all purposes useful for the maritime canal enterprise, and to pass through it freely with its vessels and those belonging to contractors employed in the service of the Inter-oceanic Canal during the term of this concession without being subject to any charge whatever, or to pay tolls or contributions of any kind to the Government of Nicaragua, or to any person or company that may, through any cause, be in charge of the administration and operation of the work and its dependencies.

The Government of Nicaragua will place at the disposal of the company, free of all expenses and charges, all the lands that may be required, as well as the materials found thereon, or on those belonging to the government and that may be utilized by the company in the execution of this work.

ARTICLE XV.

All expenditures for surveys, construction, maintenance and operation of the Inter-oceanic Maritime Canal shall be borne by the concessionary company, without any subvention in money or guaranty of interest on the part of the Republic, nor other concessions than those specified in the present agreement.

ARTICLE XVI.

The company shall construct, at its expense, and maintain in good condition, two large ports, one in the Atlantic and one in the Pacific, to serve as termini of the canal, each of them to have a lighthouse of the first order. It shall also construct at the two points on the borders of the lake, where the canal disembogues, two ports of lesser size, with the respective lighthouses.

The company is also obliged to maintain and improve said ports by means of dredges, dikes, piers, embankments or any other works it may deem advisable, having always in view the good service of the traffic through the canal.

It may, for this purpose, select on the coasts of the two oceans, within the territory of Nicaragua, the localities which the surveys may indicate as preferable.

ARTICLE XVII.

All the space necessary, whether on the main land, in the lake, and its islands at the ports, roadsteads or rivers of the two oceans for the establishment of the canal, its paths and embankments, for depositing the materials from the excavations and cuttings for the necessary spaces to be occupied by water after raising the dams which are to be constructed in the bed of the river, for all necessary deviations of streams, as well as for reservoirs, dikes, spaces about the locks, stations, lights and beacons, storehouses, buildings, and workshops, deposits for materials, and also all those spaces necessary for the routes, service railways and canals of the same nature for the transportation of the materials to the line of the work and for feeders for the canal; in short, all lands and places necessary to the construction and operation of the canal, as laid down in the drawings, and plans made by the engineers of the company, shall be placed at the disposal of the company by the State, under the conditions set forth in the following articles.

ARTICLE XVIII.

Said lands belonging to the State will be given to the company without any compensation whatever; and, with regard to those belonging to private parties, the State charges itself with their expropriation if the company so requests. The compensation which may be required in this case shall be paid by the company.

ARTICLE XIX.

In all relating to the expropriation that may be made in conformity with the preceding article, the company shall enjoy all the immunities and privileges which the laws of the country accord to the State; so that in no case shall the company be obliged to pay more than the State would under similar circumstances.

ARTICLE XX.

The government obliges itself to place the company, within six months after its request, in possession of up to one thousand (1,000) manzanas of land between the lake and the Pacific, at such places as the company shall designate, but they are to serve exclusively for cutting the canal, its havens, ports and other accessory works. The government shall on its own account cause the necessary expropriation to be made, and the company shall pay to it for all indemnity the sum of fifty thousand dollars (\$50,000) American gold. This payment to be made by the company in Managua within four months after the date of its request.

ARTICLE XXI.

The company shall have the right to take, free of charge, from the public lands for the purpose of construction, operation and maintenance of the canal, whatever materials may be found on them, especially timber for construction and for fuel, the lime, stone, clay for bricks and earth for fillings, as may be necessary. As regards materials found on private lands, the company shall pay for what it may need thereof, enjoying in this respect the same rights and privileges which the State enjoys according to law.

ARTICLE XXII.

Should the company require to occupy, temporarily, and during the construction of the canal, lands in the territory of Nicaragua which are not included in those designated in Articles 17, 18 and 21, it shall not be obliged to pay an indemnity for them if they are public lands; and the State shall not have the right to sell or dispose of them in any other manner after the company has determined to occupy them, unless under the reservation of this right, whose limit shall be the completion of the works on the Inter-oceanic Canal. Should the lands belong to private parties, the company shall enjoy, in regard to their temporary occupation, all the rights and privileges which the law accords to the State, with the special privilege of occupying them immediately after the declaration of necessity and utility, and after paying the compensation, which shall not exceed that which the State should be compelled to pay in a similar case.

ARTICLE XXIII.

The Republic of Nicaragua, desiring to assist the company efficaciously in the construction of the Inter-oceanic Canal, a work in which it takes the deepest interest, cedes in fee simple to the said company the public lands hereinafter mentioned, in alternate lots with other similar ones which it reserves to itself, and of the dimensions and in the places as specified hereinafter.

1st. On the left bank of the River San Juan, from the Atlantic to Castillo Viejo, lots of three miles frontage on the canal and six miles in depth from the banks of the river. Where the canal diverges more than six miles from the banks of the river the lots are to be measured on both sides of it and shall be three miles wide and six miles deep. And where this distance is less than six miles the lots shall be three miles front and three miles deep, and they shall be measured from the bank of the canal to the river, taking what may be lacking from the opposite bank of the canal.

2nd. Three miles distance from Castillo up stream, on the right bank and up to the lake, lots of two miles in depth and two of frontage on the canal. From the lake along its south shore to the River Sapoa and thence to the River Lajas, lots of one mile frontage and one mile depth. On the left bank of the river from a point in front of Castillo and up to the lake, lots of three miles of frontage on the canal and four miles in depth.

3rd. On the north shore of the lake as far as the River Tule, lots of two miles frontage on the lake and two miles deep.

4th. In the places which the company selects in accordance with the government, of the existing public lands, forty (40) lots, each four miles frontage by five miles deep, reserving always the acquired rights.

It is understood that the government reserves around each of the forts Castillo and San Carlos, the lands included in a circle of one and one-half ($1\frac{1}{2}$) miles radius, whose centre shall be the respective fortresses.

As a general rule, at the extremities of the Inter-oceanic Canal and at its points of contact with the lake, the opposite lots will be allotted one to the government and one to the company; but if this be not possible the first will belong to the government.

From the Atlantic to the lake, that part of the river bed occupied by the canal shall be considered as part of the latter for all purposes of this article.

The measurement and setting out of all lands ceded by this contract shall be made at the expense of the grantees under the supervision of the government.

The State shall vest in the company the possession of said lands so soon as the said company shall begin operations on the canal. Operations shall be regarded as begun when the provisions set forth in Article 47 shall have been complied with. The final deeds shall not be granted except as the work of the canal progresses and in due proportion.

ARTICLE XXIV.

In the unforeseen case that a new survey should show the necessity of adopting another line for the construction of the canal, which varies wholly or in part from the line set forth in Article 13, the company shall have the right to the lands and other elements necessary for the construction of the canal according to Articles 16, 17, 18, 19, 21 and 22.

The company shall, in that event, also have the right to the lands mentioned in the preceding article, in the same proportions, conditions and dimensions therein established with the single proviso that if it alter the line, the localities whence these lands shall be taken shall be altered accordingly.

ARTICLE XXV.

The State reserves the right to occupy, in the several lots of land granted the company, such places as it may need for such roads and public buildings as it may deem convenient. In the same manner it may use timber and other building materials found on such lands whenever they may be necessary for any work upon which it may determine. However, these lands, with all their products, vegetable and mineral, shall be subject to the laws of the country so soon as they become the property of individual citizens, by transfer from the company, and then, should the State need them for the ends set forth in this article, or for any others, it shall make compensation to their owners according to law, without any right on the part of the expropriated owners to reclaim against the company.

Should the company have improved the lands so taken for purposes of use, ornament or pleasure, the State shall be bound to reimburse it for such damages as it may have suffered, according to the assessment of experts.

ARTICLE XXVI.

Mines of coal, stone, gold, silver, iron or other metals situated in the lands granted to the company, shall belong to it by right, without need of previous "denunciation," it having the right to work them when considered expedient, subject to the laws of the country.

ARTICLE XXVII.

The company shall also have the right to utilize for its account, for sale or exportation, the lumber in the forests situated in the lands ceded to it by the State, from the time they enter into possession of them in accordance with this contract; that is, from the time of commencement of the works, always saving the acquired rights.

ARTICLE XXVIII.

From the day on which the present concession is ratified by Congress, the public lands included in those necessary for the construction of the canal cannot be sold, nor can any of those ceded to the company on the banks of the canal, by Article 28. Nor can they be leased to the prejudice of the company.

ARTICLE XXIX.

The company shall have the right, throughout the extent of the canal as well as at its mouths on both oceans, and in the lake and throughout the extent of the lands ceded by virtue of Articles 16, 17, 22 and 23, to enter upon the work of locating, leveling, excavating, dredging, and in general any other work of whatsoever nature that may be judged useful for the establishment and feeding of the canal, or for its operation, preservation and maintenance. The company is specially authorized to execute along the canal line and on the banks of the River San Juan and its affluents, within the territory of Nicaragua, and also on the tributaries of Lake Nicaragua, the lakes or water courses which can be utilized in their flow to the Pacific, the system of dikes, rectifications, dredgings, embankments, dams, cuts, location of buoys, and in general all the works that in the opinions of the engineers of the company are deemed indispensable, for the construction, feeding, navigation and operation of the canal. The company may also do all works of like character deemed necessary at the entrances of the canal into Lake Nicaragua, as well as the lake itself, in accordance with the route that may be determined upon in order to secure in it easy navigation, and as may be found necessary in the other lakes or lagoons that are to be traversed.

The embankments, fillings and dikes formed in the mouths of the canal in the lake and in the ports on the oceans, by deposits of materials resulting from the excavations of the canal, shall belong in fee simple to the company; the government having the right to use them if necessary, after compensation made. But it may never obstruct said ports nor widen the beaches in front of them, unless there is absolute necessity to do so, and in this case the embankments and fillings that it may be necessary to construct in front of the ports shall belong to the Republic.

In general the company shall have the right to use all the lakes and rivers of Nicaragua, the waters of which may be necessary, in the judgment of the engineers of the company, for the construction and supply of the canal and for maintaining its operations. It being understood that the damages caused to private parties by the deviation of the water courses shall be compensated for by the company according to a just assessment by experts in agreement with the laws of the Republic.

ARTICLE XXX.

The company shall not import merchandise into the territory of the Republic for the purpose of trafficking without paying the import duties established by law. But it may import free of custom duties, and of any tax whatsoever, the articles needed for the works of the enterprise, such as surveys, examination of localities, construction, use, operation, maintenance, repairs and improvements of the canal; for the telegraphic service and for that of the railways; for running the workshops the company may keep in operation; and such articles may consist of tools, machinery apparatus, coal, limestone of all classes, lime, iron and other metals, raw or manufactured, mining powder, dynamite, or any other analogous substance. These articles may be transported between whatever points they may be required during the work of opening of the canal, and be discharged and stored free of all local taxes.

The company may import free of duties and taxes, during the work on the canal, provisions and medicines absolutely necessary for its own consumption. Goods, the commerce of which is not free, are excepted from the privileges contained in this article, which goods, excepting powder, dynamite and other explosives, remain subject to the requisites and duties prescribed by the laws.

ARTICLE XXXI.

The vessels employed by the company as tugboats or for the service of the canal shall be free from all duties and also the materials for their repair and the fuel they use. The vessels and appurtenances, from whatever place they may be coming for the use of the company, shall also be exempt from all duties.

ARTICLE XXXII.

The government will establish such regulations as it may judge necessary to prevent smuggling and to maintain public order in the region of the canal.

The company is bound to lend its assistance for the enforcement of such regulations. But in the free zone along the margin of the canal, as hereinafter provided, measures for the prevention of smuggling shall be limited to vigilance on the part of the employé or employés whom it may concern without any further measures being taken against passengers, vessels or their cargoes, excepting when an attempt at smuggling is discovered; it being the intention of the State that there should be the most ample liberty of transit by the canal for persons and property, with the sole limitations established by this contract. Consequently the company shall have the right to discharge and reload ships in transit at such points as may be necessary in order to make repairs, lighten the vessel, shift cargo, or on account of any accident that renders it absolutely necessary, without being subject to search, exactions or contributions of any kind, provided that in each case, and before beginning operations, the nearest custom house authority shall be notified.

ARTICLE XXXIII.

The government shall lend its protection, in conformity with the laws of the country, to the engineers, contractors, employés and laborers engaged in the preliminary surveys or in the works of construction and operation of the canal.

ARTICLE XXXIV.

The company shall be exempt from all forced loans and military exactions in time of peace and of war. The foreign agents and employés shall likewise be exempt from direct contributions, forced loans and military exactions during the time they are in the service of the canal, but they shall pay the taxes established by the laws, if they acquire real property.

ARTICLE XXXV.

The company may freely introduce immigrants into the lands ceded to it, and the employés and workmen needed in its works and workshops. Asiatics, however, are excepted. Both the immigrants and the employés and workmen will be subject to the laws of the Republic and the regulations of the company. The government assures them aid and protection, and the enjoyment of their rights and guarantees in conformity with the constitution and the national laws during the time they remain on Nicaraguan territory.

ARTICLE XXXVI.

The Government of Nicaragua assures to the company and its agents, under the laws of the country as it does to the other inhabitants, the full enjoyment of the guarantees and rights which the constitution and the same laws grant to them. And reciprocally the company and its agents bind themselves strictly to respect the laws and regulations that are in force in Nicaragua, and especially to comply with the executory judgments of the tribunals without considering themselves vested with other rights than those which the laws concede in favor of the Nicaraguans.

ARTICLE XXXVII.

The government shall establish all along the line of the canal, included between the two terminal ports, such police stations and revenue offices as in its judgment are necessary to preserve order in the region of the canal, and for the observance of the fiscal laws of the Republic. All expenses incident to this service, including those of buildings, endowments,

salaries and allowances of employes and transportation of the forces, shall be paid to the government by the company on such terms and conditions as may be established, taking into consideration the requirements and necessities of such service. The company, however, shall have the power to establish guards and watchmen for the service of the canal and the enforcement of its regulations.

ARTICLE XXXVIII.

Contracts for labor on the canal shall enjoy the privileges which the laws of the country accord to agricultural contracts, provided they be clothed with the formalities that the laws require in such contracts. And the contracts in regard to canal labor that the company execute in foreign countries shall be valid and lawful in Nicaragua during the term stipulated in them, provided they do not violate the laws of the Republic; provided also the documents containing them be presented to the proper authorities, with due authentication, that they may be registered.

ARTICLE XXXIX.

The company shall be exempt during the period of this concession, in peace and in war, from all manner of taxes upon the real property it may acquire by virtue of this contract, and from every kind of direct contributions, local taxes, or any other tax relating to the property and use of the canal, its buildings and constructions appertaining thereto, in its entire length, including those that are situated in the ports and maritime establishments on the two oceans, as also the lands conceded to the company for the whole term of the privileges. This franchise is not assignable to those who buy the real estate which the company may dispose of by virtue of this concession.

ARTICLE XL.

The Republic of Nicaragua shall not establish any tonnage, anchorage, pilot, lighthouse dues or charges of any kind whatsoever upon vessels of whatever class, or upon the merchandise, baggage and passengers which may pass through the canal from one ocean to the other, all such dues being reserved for the benefit of the Company, as hereinafter set forth in Article 48.

But all such merchandise as shall be loaded or discharged at any point of the canal, intended for sale, shall pay the import and export duties fixed by the revenue laws of the State.

ARTICLE XLI.

With the view of securing the most ample freedom in the transit of persons and property, and in order to remove as far as possible occasions for disagreeable questions, there shall be on each side of the canal a free zone, the extent of which shall be one hundred yards, measured from the water's edge in the canal, it being understood that the borders of the lake shall not be considered as margin of the canal for the purpose of this stipulation.

All traffic declared illegal by the laws of the Republic shall be prohibited within the said zone, and the revenue authorities charged with watching and preventing smuggling shall act in conformity with the stipulations in Article 32.

It is expressly agreed that every vessel that passes through the canal shall carry on board an officer named by the government when the authorities think it necessary, and this employé shall act in conformity with the law in case he discovers its infringement.

The two ports to be constructed for the entrance and exit of the canal on the two oceans shall be declared free ports, and they shall be recognized as such from the beginning of the work to the termination of this concession.

The government in agreement with the company shall establish, by special decree, the limits of the freedom of these ports, which limits shall not extend beyond the waters of the port, which are those included between the mouth of the canal and the entrance to the said ports.

ARTICLE XLII.

For the proper administration of the canal and its appurtenances, and in order to facilitate its construction and operation, the company shall establish the necessary regulations, which shall be binding on all persons found in its waters or its appurtenances: the sole reservation being that the rights and sovereignty of the State be respected.

It being understood that the company in the exercise of the powers conferred by this Article may not make other regulations than those necessary for the administration and particular management of the canal, and that before executing and enforcing these regulations they shall be submitted to the government for approval. The State will lend the aid of its authority for the enforcement of these regulations.

ARTICLE XLIII.

By way of compensation for the expense of surveys, construction, maintenance and operation of the canal, which under the present concession shall be at the cost of the company during the period of said privilege, it shall have the right to establish and collect for the passage of all kinds of vessels, travellers and merchandise through the canal, and in the waters and ports pertaining to it, taxes on navigation, tonnage and pilotage, towage, storage, lay days, anchorage, light, roadstead dues, wharfage, hospital dues, and any other similar charges in conformity with the tariff to be established by it in accordance with Article LII. of this contract.

These tariffs may be modified by the company at any time on condition that all modifications that may be introduced shall previously be communicated to the government, which in case of finding them within the limits established by the said Article LII., shall cause them to be complied with as if they were regulations enacted by itself.

The payment of all the tariff dues shall be exacted without any exception or preference, and under identical conditions, from all vessels, whatever be the place they come from or their nationality, with the exception stipulated in the following Article.

ARTICLE XLIV.

As compensation for the privileges and concessions that Nicaragua grants by this contract, it is hereby stipulated that the Republic shall enjoy the special privilege that Nicaraguan vessels sailing under the Nicaraguan flag may navigate the canal at a reduction of fifty (50) per centum from the general tariff while engaged in the coasting trade or in the reciprocal trade with the other Republics of Central America. It is declared that the vessels referred to in the preceding paragraph must be exclusively of the Register of the Republic, and they must not be owned, either in whole or in part, by citizens of other countries.

A reduction of fifty (50) per cent. from the general tariff is also granted to vessels that begin their voyage for a foreign country in any of the ports belonging to the Republic, with a cargo wholly composed of products of the country. All the privileges to which this Article refers shall be extended to the other Republics of Central America whenever Nicaragua shall find itself free from international obligations which may prevent it, or whenever one or more of the said Republics shall form a single nation with Nicaragua. The company cannot collect any navigation dues whatever upon vessels and craft navigating the Lake of Nicaragua and its prolongations without passing out of the locks. The Nicaraguan vessels of war, and in the case above provided those of the Republic of Central America, shall not pay any dues on passing through the canal.

ARTICLE XLV.

In case it may be possible to utilize the waters of the canal and its dependencies for the irrigation of plantations, gardens and streets, or for the supply of towns that may be without it, or as motive power for private enterprises, the company shall have power to supply it, collecting dues in proportion to the amount furnished, according to the tariff that it may establish in agreement with the government.

ARTICLE XLVI.

In view of the existence of an exclusive privilege granted by the Republic in favor of Mr. F. Alf. Pellas, by a contract ratified on the 16th of March, 1877, for the navigation by steam on the lake and rivers for the purposes of the internal commerce of the Republic, the Canal Company shall have the right of expropriation against Mr. Pellas, as regards his rights and properties, on just assessments by experts, after making a corresponding compensation according to the laws of the Republic.

It is also stipulated that the company binds itself to pay to the government of the Republic all it may from now on expend in any way for the improvement of the navigation of the river and the port of San Juan del Norte. This payment shall be made within six months of the date of the beginning of the works of the canal, and according to the original accounts of the corresponding office.

ARTICLE XLVII.

The company shall undertake at its expense the final surveys of the ground and the location of the line of the canal by a commission of competent engineers, two of whom shall be appointed by the Government of the Republic, which shall protect as far as it may the said commission.

There is granted to the concessionary company a term, not exceeding one year, in which to commence the final surveys for the canal, and one year and one half additional for completing them; to organize the executing company, and commence the work of construction. Said terms shall begin to be counted from the date of the ratification of the present contract by the Nicaraguan Congress, published in the official paper, which shall be construed as notification. Furthermore, said terms are not to be extended, and it is understood that operations are not considered to have been begun if during the first year of the work two million dollars (\$2,000,000) are not expended on it.

ARTICLE XLVIII.

A term of ten years is also granted to the company for the construction, completion and opening of the canal for maritime navigation. However, should events of main force arise duly justified, and sufficient to impede the regular progress of the works during the period of the said ten years, an extension shall be granted equal in duration to the time that may have been lost by such delays.

If, at the expiration of the ten years aforesaid, the works should not be completed so as to have the maritime communication between the two oceans opened, in consideration of the great capital the company may have invested in the enterprise, and of the good will and ability it may have shown, and the difficulties encountered, the Republic binds itself to concede a new extension.

ARTICLE XLIX.

As a guaranty of the fulfillment of the obligations which the company incurs in accordance with Article 47, it shall deposit to the order of the Government of Nicaragua in a bank or in a mercantile house in the city of New York, which the government may designate, and within sixty (60) days from the date of the ratification of this contract, the sum of one hundred thousand (\$100,000) dollars, American gold, which the company shall forfeit to the Republic if it do not fulfill the said obligations; and which sum otherwise shall be considered an advance to the government on account of the necessary expenses of payment of the police of the canal according to the stipulations set forth in Article 37. This deposit, as soon as made, shall be at the disposal of the government.

ARTICLE L.

In consideration of the valuable privileges, franchises and concessions granted to the company by this contract, the Republic shall receive in shares, bonds, certificates or other securities which the company may issue to raise the corporate capital, six per centum of the total amount of the issue.

Such shares, bonds, certificates or other securities shall be free of all payment on the part of the Republic, being considered as paid in full. The six per centum shall in no event be less than four million dollars (\$4,000,000), that is to say, forty thousand shares or obligations of whatsoever kind of one hundred (\$100) dollars each.

Of said shares, bonds, certificates or securities of whatsoever class, two-thirds shall not be transferable; but all shall participate in the benefits, interests, partitions, dividends, sinking fund, rights, privileges, and in all the advantages given to paid up shares without any distinction. The Government in its capacity of shareholder shall besides have the right to appoint one director who shall represent its interest in the board of directors of the canal company from the time of its definite establishment. The shares referred to in this article shall be delivered to the agent the government may appoint to receive them, and as soon as the company shall be ready to issue the certificates for its capital.

ARTICLE LI.

In order that the canal association may indemnify itself for the expenses it may have had to incur for the verifications, preparations, explorations and surveys hereinbefore mentioned, and for all other expenditures that it will have to make until the definite organization of the company, it shall have the right from the time of the organization of said company to six per cent- in shares, bonds, certificates or other securities which the company may issue for the purpose of raising the corporate capital, and which are to be issued in excess of the capital to be subscribed.

These bonds, shares or securities shall be identically like the subscription shares, and issued from the same register or stock book. As a consequence, they shall participate in all benefits, interests, partitions, dividends, sinking fund, rights, privileges and of all the advantages given to the paid up shares, bonds or securities without any distinction whatever.

ARTICLE LII.

From the receipts of the enterprise the company shall take in the first place the necessary amount to cover all the expenses for maintenance, operation and administration; all the sums necessary to secure the interest which shall not exceed six per centum, and the amortization of the obligations and of the shares, and what remains shall form the net profits, of which at least eighty per centum (80 per cent.) shall be divided among the shareholders, it being agreed that after the lapse of ten years after the completion of the canal the company shall not divide among the shareholders in payment of dividends, directly or indirectly, by issue of shares or otherwise, more than fifteen per centum (15 per cent.) annually or in this proportion, from dues collected from the aforesaid canal, and where it shall appear that these dues yield a greater profit, they shall be reduced to the fixed limit of fifteen per cent. per annum.

ARTICLE LIII.

The present concession shall be forfeited:

1st. Through the failure on the part of the company to comply with any of the conditions contained in Articles 8, 46, 47, 48 and 49.

2d. If the service of the canal, after its completion, be interrupted for six months, except in cases of main force.

When the concession shall have been declared forfeited, from whichever of these causes the public lands granted by this convention will revert to the Republic, in whatever state they may be, and without compensation even in the case that buildings may have been erected thereon.

Such lands shall be excepted as may have been alienated to private parties by the company, with the formalities prescribed by law, provided that such alienations shall not have taken place within the six months preceding the date on which the company may have become legally liable to the penalty herein established.

ARTICLE LIV.

On the expiration of the ninety-nine years stipulated in this concession, or in the event of the forfeiture contained in the preceding article, the Republic shall enter upon possession in perpetuity, of the canal, of works of art, lighthouses, storehouses, stations, deposits, stores, and all the establishments used in the administration of the canal, without being obliged to pay any indemnity to the company.

There shall be excepted from this condition, the vessels belonging to the company, its stores of coal and other materials, its mechanical work-shops, its floating capital and reserve fund, as also the lands ceded to it by the State, excepting those in which are established the works indicated in the first part of this article, and which will revert to the State together with their immediate appurtenances as necessary for the service of the canal, and as an integral part of the same.

But the company shall have the right at the expiration of the aforesaid term of ninety-nine years, to the full enjoyment of the free use and control of the canal in the capacity of lessee, with all the privileges and advantages granted by the said concession and for another term of ninety-nine years, on the condition of paying twenty-five per cent. of the annual net profits of the enterprise to the government of the Republic, besides the dividends due to it for its shares in the capital stock.

The company furthermore shall have the right to fix at its discretion the dues referred to in Article 43 of this concession, so that the shareholders still receive dividends not to exceed ten per centum per annum on the whole capital after deducting the payment of twenty-five per cent. of the net gains to the government.

At the expiration of this second term of ninety-nine years the government shall enter into perpetual possession of the canal and other properties referred to in the first part of this article, including also in this possession, all that which is included in the said first part with the exception of the reserve and the amortization funds. The failure to comply with any of the terms of the lease shall terminate it, and the State shall enter into possession of the canal and other works belonging to it in accordance with the provisions of the preceding paragraph.

ARTICLE LV.

Any misunderstanding that may arise between the State of Nicaragua and the company in regard to the interpretation of the present stipulations shall be submitted to a court of arbitrators composed of four members, two of which shall be appointed by the State and two by the company.

These arbitrators shall be designated by each of the parties within the period of four months from the day on which one of the contracting parties shall have informed the other in writing of the want of agreement on the point at issue. Should one of the parties allow the aforesaid term to pass, it shall be considered as assenting to the opinion or claim of the other,

The majority of the votes of the arbitrators shall decide finally and without recourse. In case of a tie vote the arbitrators shall select, by mutual consent, a fifth person who shall decide. If unable to agree to such nomination, they shall draw by lot the names of the diplomatic representatives accredited to Nicaragua, and the first one drawn out shall exercise the functions of the fifth arbitrator; he shall either adopt the opinion of one or the other of the parties to the controversy, or render his opinion between these extremes, and his decision shall be final and without any appeal whatever: the fifth arbitrator failing, the second person drawn shall exercise these functions, and so on successively until a decision is reached.

Prior to the initiation of the works of opening the canal the government shall formulate with the concurrence of the company rules to be observed by the arbitrators in all matters relating to procedure.

Questions between the company and individuals residing in Nicaragua, shall be under the jurisdiction of the ordinary tribunals of Nicaragua, in conformity with the legislation

of the country. In matters pertaining to non-residents of Nicaragua the rules of international private law will be observed.

In witness of the foregoing stipulations, we have signed two instruments of the same tenor in Managua, on the 28d day of March, one thousand eight hundred and eighty-seven.

AD. CARDENAS,
A. G. MENOCAL

The government, finding the foregoing contract in conformity with the instructions transmitted, determines to approve it in all its parts and to submit it to Congress for its ratification;

Managua, April twelfth, one thousand eight hundred and eighty-seven.

E. CARAZO,
CANTON.

The Acting Sub-Secretary of the Interior.

Done in the Hall of Sessions of the Chamber
of Deputies, Managua, April 20, 1887.

TOMÁS ARMIJO.
LEOPOLDO M. MONTENEGRO.

LUIS E. SAENZ.

To the S. E. P., Hall of the Senate,
Managua, April 23, 1887.

JOAQUIN ZAVALA.

S. MORALES.

Therefore: be it executed.

ELIODORO RIVAS.
Managua, April 24, 1887.
E. CARAZO.

The Sub-Secretary of the Interior in charge of the office.

ALEJANDRO CANTON.

Accepted on the same date.
CANTON.

A. G. MENOCAL

I do hereby certify the preceding signature of the Sub-Secretary of the Interior, which reads Alejandro Canton, to be genuine.

Managua, April 25, 1887.

JOAQUIN ELIZONDO.

APPENDIX III.

CONCESSIONS AND DECREES OF THE REPUBLIC OF COSTA RICA TO THE NICARAGUA CANAL ASSOCIATION.

THE CONSTITUTIONAL CONGRESS OF THE REPUBLIC OF COSTA RICA, IN THE EXERCISE OF THE POWERS GRANTED TO IT BY SECTION 4, ARTICLE 78 OF THE CONSTITUTION.

ARTICLE FIRST.

DECREES.

The contract entered into on the 21st of July last, between the Honorable Minister of Public Works, authorized for this purpose by the Honorable President of the Republic, on behalf of the Government of the same, and Mr. Aniceto G. Menocal on behalf of the Nicaragua Canal Association, for excavating and operating an inter-oceanic canal, crossing, either in whole or in part, through the territory of the Republic, or running along the whole or part of its boundary with Nicaragua, is hereby approved.

The aforesaid contract with the modifications agreed to by Congress reads literally as follows:

The undersigned, PEDRO PEREZ ZELEDON, Secretary of State for the Bureau of Public Works, especially authorized by the Honorable General, President of the Republic, to celebrate ad-referendum the present contract, party of the first part, and ANICETO G. MENOCAL, representing the Nicaragua Canal Association, with full powers from it, and also authorized for this purpose by the Executive Committee of the said Association, party of the second part, have revised the contract for the canal made in Washington on the 17th of last May, by the party hereto of the first part, in his capacity as Envoy Extraordinary and Minister Plenipotentiary of the Republic of Costa Rica, to the Government of the United States of America, and Mr. HIRAM HITCHCOCK, President of the aforesaid association; the said contract with the modifications now agreed to by the undersigned, reads as follows:

ARTICLE I.

The Republic of Costa Rica grants to the NICARAGUA CANAL ASSOCIATION, its successors and assigns, the exclusive privilege to excavate and operate a maritime canal between the Atlantic and the Pacific Oceans, running either wholly or in part through the territory of the said Republic or along the whole, or a part of her border line with the Republic of Nicaragua.

To render this contract fully efficient between the contracting parties hereto, it will be sufficient if the Association aforesaid should use or occupy for the works of the said canal, or for any of its ports in one or the other oceans, any Costa Rican waters or at least waters in which Costa Rica has joint ownership or has rights of use and navigation.

Whenever the word "ASSOCIATION" is used in this present document reference is made to the "NICARAGUA CANAL ASSOCIATION," its successors and assigns.

ARTICLE II.

The canal shall be of sufficient dimensions for the free and commodious passage of vessels of the same size as the large steamers used for ocean navigation between Europe and America.

ARTICLE III.

The State declares this work to be one of public utility.

ARTICLE IV.

The duration of the present privilege shall be for ninety-nine years, to be counted from the day on which the canal shall be opened to universal traffic.

During the aforesaid period the association shall have the right to construct and operate within the territory of Costa Rica, a railroad along the whole extent of the said canal, or those parts of the same which it may consider convenient for the better service and operation of the said work.

The Republic binds itself not to make any subsequent concessions for the opening of a canal between the two oceans as long as the present privilege lasts.

The Republic will also abstain during the same period, from granting, within a zone of twenty-five miles along the canal, concessions for railroads from sea to sea, that might compete with the canal in the traffic between foreign nations. This restriction shall not prevent the construction of new railroads that may be convenient for Costa Rica to build to the canal, or to any point on the northern frontier of the Republic, either connecting or not with any other railroads.

ARTICLE V.

The grantee association shall have the right to establish such telegraph lines as may be considered necessary for the construction, management and operation of the canal.

The Government shall have the right to use the telegraph lines of the company from any station to any station that may be included within the line from sea to sea, without being obliged to pay the company for such service.

ARTICLE VI.

The Government of the Republic declares and accepts that the ports at each extremity of the canal and the canal itself from sea to sea, during the time of this concession, shall be neutral; and consequently in case of war between other nations, or between one or more nations and Costa Rica, the transit through the canal shall not be interrupted for such cause, and the merchant vessels and individuals of all nations of the world may freely enter the aforesaid ports or pass through the canal without molestation or detention.

In general, all vessels shall freely pass through the canal without distinction, exclusion or preference, whether of persons or nationalities, provided that they pay the dues and comply with the rules established by the association for the use of the said canal and its dependencies.

The transit of foreign troops and vessels of war shall be regulated by such provisions in regard thereto, as are now or may be hereafter established in the treaties between Costa Rica and other powers, or by international law. But the entrance of the canal shall be strictly forbidden to vessels of war of any nation which may be at war with Costa Rica, or with any other of the republics of Central America.

Costa Rica shall endeavor to obtain from the powers that are to guarantee the neutrality, that in the treaties to be made for that purpose, they shall also bind themselves to guarantee the same conditions to a zone of land parallel to the canal, and also to a maritime zone in both oceans, the dimensions of which shall be fixed by such treaties.

ARTICLE VII.

The present concession shall be transferable only to such company or companies as may be organized for the purpose of constructing or operating the canal, and in no case to foreign governments or to foreign public powers.

Nor shall the association have the right to transfer to any foreign government or public power any part of the lands granted to it by this contract. But it shall have the right to make such transfers to private parties under the same restrictions.

The Republic of Costa Rica shall not *transfer* its rights and privileges in this respect to the canal to any foreign government or public power.

The people of all nations shall be invited to contribute the necessary capital to the enterprise, and it shall be sufficient for the fulfillment of this requirement to publish an advertisement for twenty consecutive days in one of the principal daily papers of each of the cities, New York, London and Paris.

ARTICLE VIII.

The capital stock (*capital social*) of the final company which is to operate the canal shall consist of shares of the face value of one hundred dollars each, which shall be issued in such amounts as may be deemed necessary. The issue and transfer both of these shares and of all the bonds and obligations that the company may issue shall be exempt from stamp dues and from all other taxes or imposts now established or to be hereafter established in the Republic.

A five per centum, at least, of the capital stock with which the said company may be organized shall be reserved for such Central American Governments and citizens as may wish to subscribe.

As soon as the said company is ready to open subscription books, notice shall be given by it to the Governments of Costa Rica and Nicaragua, which shall invite the other governments of Central America, and through them private parties, to subscribe.

The shares which, within six months to be counted from the date of the notice given to the government of the opening of the subscription books, are not paid for shall remain at the free disposition of the company.

ARTICLE IX.

The company shall be organized in the manner and under the conditions generally adopted for such companies. Its principal office shall be either in the City of New York or in such place as may be deemed convenient.

Its first board of directors shall be composed of persons, one-half, at least, of whom shall be chosen from those members of the NICARAGUA CANAL ASSOCIATION who were promoters of the enterprise.

ARTICLE X.

The Government of Costa Rica, in its capacity of stockholder in the final company as hereinafter provided, shall have the perpetual right of appointing one director who shall be an integral part of the Board of Directors of the said company, with all the rights, privileges and advantages conferred upon the other directors of said company by the charter, by-laws and statutes of the company and the laws of the country under which it shall organize.

The government, in the said capacity of stockholder, shall also have the right to take part in the elections that the company may hold.

ARTICLE XI.

The said final company is bound to keep a representative in Costa Rica, vested with ample powers for everything that may be of interest to the company, either actively or passively.

ARTICLE XII.

The association shall have the most ample liberty to select and adopt the route which it may deem most convenient, advantageous and economical between the two oceans for the excavation, construction and operation of the canal and its dependencies and ports whether the same passes wholly or in part through the territory of Costa Rica or only along its border line.

Should the canal deviate from the River San Juan, in that section of the same in which Costa Rica has the right of navigation, the association binds itself to establish at such points as the engineers may deem proper, a communication between such parts of the San Juan River as may not be canalized and the dividing level of the canal, to the end of facilitating, without payment of any dues whatever, the navigation of Costa Rica vessels,

between the non-canalized part of the San Juan River and the canal, by means of a lock or series of locks suitable for the navigation of vessels of six feet draught.

It is understood that this obligation does not in any manner bind the association to place or to keep in navigable condition the lower part of the river which these locks may be intended to place in communication with the canal.

ARTICLE XIII.

All expenditures for surveys, construction, maintenance and operation of the canal shall be borne by the association without any subvention in money or guarantee of interest on the part of the Republic.

ARTICLE XIV.

The association shall construct, at its expense, and shall keep in good condition two large ports, one on the Atlantic and one on the Pacific, at such points or localities as it may select within or without the territory of Costa Rica to serve as termini of the canal; and each of them shall have a light-house of the first order.

ARTICLE XV.

All the area within the territory of Costa Rica, whether at the ports, roadsteads or rivers of the two oceans which may be necessary for the establishment of the canal, its paths and embankments, or which may be occupied and covered by water after raising the dams which are to be constructed in the beds of the rivers, or for all necessary deviations to be made as well as for reservoirs, dikes, spaces about the locks, stations, light-houses and canals, store-houses, buildings and workshops, deposits for materials, and also all those required for the routes, service railways and canals of the same nature, for the transportation of materials to the line of the work and for feeders of the canal; in short all lands and places within the territory of Costa Rica necessary to the construction and operation of the canal, as may be laid down in the final drawings and plans made by the engineers of the association shall be placed by the State at the disposal of the said association under the conditions set forth in the following Articles.

ARTICLE XVI.

Such unappropriated lands as belong to the State shall be given to the association without any compensation whatever, and with regard to those lands belonging to private parties the State undertakes to condemn them, should the association demand it.

The compensation which in agreement with the laws of Costa Rica may have to be paid in such cases, shall be paid by the association, and to it shall be added the amount of the expenses and costs of the respective actuations, in such a way that the National Treasury shall suffer no loss.

ARTICLE XVII.

In all relating to the condemnation to be made under the provisions of the preceding Articles the association shall enjoy all the immunities and privileges that the laws of the country grant to the State, so that the association may not be obliged to pay more than the State would under similar circumstances.

ARTICLE XVIII.

For the construction, maintenance and operation of the canal, the association shall have the right to take free of charge, from the lands belonging to the State whatever material of a spontaneous production of the land that may be found on them, especially timber for construction and fuel, and lime stone, clay for bricks and earth for fillings that are to be made. As regards materials of the said class found on lands belonging to private parties, the association shall have the same rights and privileges granted by the laws to the State.

ARTICLE XIX.

If it should be necessary for the association to occupy temporarily and during the construction of the canal lands in the territory of Costa Rica which are not included in those

designated in the Articles XV, XVI, and XVIII, it shall not be obliged to pay any compensation for them if they are unappropriated lands. And the State shall not have the right to sell or dispose of them in any other manner after the association has once determined to occupy them, unless under the reservation of this right the limit of which shall be the execution of the works of the Inter-oceanic Canal. Should the said lands belong to private parties, then the association shall enjoy so far as the temporary occupation thereof is concerned, all the rights and franchises which the laws grant to the State with the special privilege of occupying them immediately after the declaration of utility and necessity, and after payment of the proper compensation, which shall never exceed that which the State would be obliged to pay in a similar case.

ARTICLE XX.

The Republic of Costa Rica desiring to aid efficiently the association in this enterprise cedes in fee simple to the said association the public lands hereinafter mentioned, in alternate lots, with other similar ones which it reserves for itself, to wit:

1st On the right or southern bank of the San Juan River, from a point three English miles below Castillo Viejo to the confluence of the San Carlos, should the canal follow the valley of the San Juan, lots fronting on the canal three English miles front by six deep.

2d. Between the San Carlos River and the Atlantic, should the canal pass wholly or in part through the territory of Costa Rica, or along the boundary of Costa Rica, lots of three English miles frontage on the canal and four deep.

3d Should the route of the Selinas Bay be adopted, lots of two English miles frontage on the canal by two deep in the Costa Rican territory crossed by the canal or along which it may run, from the Pacific Ocean to a point two English miles distant from the mouth of the Sapoa River in the Lake of Nicaragua.

4th. Should the canal deviate from the San Juan River more than four miles towards the interior of Costa Rica, lots to be measured on both sides of the canal of two miles front and two deep. Should the deviation be less than four miles, then the lots of the northern bank of the canal shall have a front of two miles and extend in depth until they touch the San Juan River.

5th From the Rio Frio to the Sapoa on the south coast of the Lake of Nicaragua, at two miles distant from the same and following the curve of its bank, lots of two English miles front by two deep.

6th. In the places where the company in accordance with the government may select from the existing unappropriated public lands, twenty-five lots, each two English miles in frontage by four deep. As a general rule, at the extremities of the Inter-oceanic canal, should the same be within the territory of Costa Rica, the opposite lots will be allotted, one to the government and one to the company; but, if this be not possible, the first will belong to the government.

The State shall vest in the association the possession of said lands as soon as the location of the canal is finally determined and its construction begun by the association.

The rights acquired by private parties in the lands set forth in the preceding clauses are hereby reserved.

The measurement and setting out of all lands ceded by this contract shall be made at the expense of the grantee, with the intervention of the government.

The final title deeds shall be issued in due proportion as the work advances and not before.

Between the Atlantic and the point three miles below Castillo Viejo, all parts of the San Juan and Colorado Rivers occupied by the canal shall be considered for the purposes of the present Article, as a part of the said canal.

It is hereby understood that the whole of the lands transferred to the association by Costa Rica, in the different places and in the form as set forth in the foregoing article, shall

not exceed in amount one-fourth of the total amount of lands granted to the company by the Government of Nicaragua, according to the contract made by it. Should they exceed such amount, the difference shall be deducted by reducing the number of lots mentioned in sub-division 5th of this Article.

ARTICLE XXI.

The State reserves the right to occupy, in the several lots of land ceded to the association, such space as may be needed for such roads and public buildings as it may deem convenient. In the same manner it shall have the right to use timber and other building materials which may be found on said lands, whenever they may be necessary for any work upon which it may determine. Should these lands become the property of private persons by virtue of a transfer made by the company, and the State should need them for the purpose set forth in this Article, or for some other purposes, it shall pay their owners for them in conformity with the laws, and the expropriated parties shall have no right or claim against the association.

Should the association have made improvements on the lands referred to whether for the purposes of utility, ornament or pleasure the State shall be bound to compensate it for such damages as it may suffer according to appraisals of experts.

ARTICLE XXII.

Mines of coal, gold, silver, iron or other metals and stone quarries situated in the lands ceded to the association shall belong to it by right without the necessity of previous denunciation and it shall have the right to work them whenever it may deem it convenient, subject to the laws of the Republic, but such lands as may be transferred by the association to private parties shall not enjoy this privilege.

ARTICLE XXIII.

The association shall also have the right to utilize for the works of the canal and its appurtenances the timber in the forests situated in the lands granted to it by the State from the very moment from which it enters into possession of the same under the present contract, the acquired rights always being reserved.

ARTICLE XXIV.

From the day in which the present concession shall be ratified by Congress, no alienation shall be made of any unappropriated lands necessary for the construction of the canal nor of those ceded to the association on the banks of the same. Nor shall the said lands be leased to the prejudice of the company. However, should the location of the canal not be definitely settled when this contract is ratified the line of the canal shall for the purposes of this article be presumed to follow the northern boundary line of Costa Rica.

ARTICLE XXV.

The association shall have the right of doing throughout the whole extent of the canal within the territory of Costa Rica, at the mouths of the canal on the two oceans and in the whole extent of the lands which under the present contract have been granted to it according to Articles 15, 16 and 20 all such works as may be necessary for locating, leveling, excavating and dredging the canal and all other works that may be required for the establishment, feeding, operation, preservation and maintenance of the canal.

The association is especially authorized to make along the line of the canal and on the Costa Rican bank of the San Juan River and its Costa Rican affluents and confluent, as well as on the Costa Rican rivers tributary to the Lake of Nicaragua, the lakes or water-courses which may be utilized in their flow to the Pacific or to the Atlantic; to construct dikes and dams; make rectifications, dredgings, embankments and deviations, to locate buoys, and in general to do all the works that in the opinion of the engineers of the association may be deemed indispensable for the construction, feeding, navigation and operation of the canal. The embankments, fillings and dikes which may be made within the terri-

tory of Costa Rica at the mouths of the canal on the ports on the two oceans, by using materials resulting from the excavation of the canal, shall belong in fee simple to the association; but the government shall have the right to occupy them in whole or in part after compensation made. Should any port of the canal be within the territory of Costa Rica the association shall not obstruct such port nor widen its beaches unless there is absolute necessity to do so, and in this case the embankments and fillings that it may be necessary to construct in front of said port, shall belong to the republic.

In general the association shall have the right to use all the lakes and rivers of Costa Rica, the waters of which may be necessary in the judgment of the engineers of the association to construct and feed the canal and to maintain its operations, but this right shall have the following restrictions, to wit.:

1st. The navigation of the Costa Rican rivers, which the association may dam or otherwise use for the benefit of the canal shall remain at the termination of the respective works in as good condition as it was before they were made.

2d. In the places where the waters of said rivers may overflow in consequence of the erection of dams or other artificial obstructions made by the association, the said association shall be obliged to do whatever may be practicable to prevent the formation of swamps and marshes.

3d. Such damages as may be caused to private parties in consequence of the deviation or elevation of the streams shall be compensated for by the association according to appraisals made by experts in conformity with the laws of the Republic, but the association shall not be obliged to pay more than the State would under similar circumstances.

ARTICLE XXVI.

The association cannot import merchandise into the territory of the republic for the purposes of trafficking with it without paying the custom duties established by law, but it shall have the right to import free from custom duties and of any other imposts whatsoever, the articles needed for the works of the enterprise, its surveys, explorations, examination of localities, constructions, use, operation, maintenance, repairs and improvements of the canal, and also for the telegraphic and railroad service of the same, and for the works and workshops of the company, and the said articles may consist of implements, machinery, apparatus, coal, limestone of all classes, lime, iron and other metals, whether raw or manufactured, mining powder, dynamite or any other analogous substance. These articles may be transported between whatever points they may be needed during the work of the construction of the canal, and shall be landed and stored free from all local taxes.

The association shall also have the right to import free from duties or imposts during the work of constructing the canal, such provisions, clothing for the workmen, and medicines as may be absolutely necessary for its own consumption.

Those articles the commerce of which is not free are excepted from the privileges granted in this article, and shall remain subject, with the exception of gunpowder, dynamite and other explosives, to such requisites and duties as are established by law.

ARTICLE XXVII.

The vessels that the association may employ as tugboats or for the service of the canal shall be free from all imposts or taxes of any kind whatever, and also the material to be used for their repair and the fuel that they may consume.

The vessels and their appurtenances from whatever place they may come for the service of the association shall be exempt from all duties and imposts.

ARTICLE XXVIII.

The government shall enact such regulations as it may deem necessary to prevent smuggling, and for the preservation of public order in the region of the canal lying within the territory of Costa Rica or bordering on it, and in the waters where it may exert joint jurisdiction. The company shall be bound to lend its assistance for the enforcement of

such regulations. But in the free zone along the margin of the canal, as hereinafter provided, measures for the prevention of smuggling shall be limited to vigilance on the part of the employé or employés whom it may concern, without right to any further measures either against passengers, vessels or their cargoes excepting when an attempt at smuggling may be discovered; it being the intention of the State that there shall be most ample freedom of transit through the canal for persons and property with the sole limitations established by this contract. Consequently the association shall have the right to unload and reload ships in transit at such points as may be necessary in order to make repairs or lighten the vessels or shift their cargoes, or on account of any accident that unavoidably may render it necessary, without being subject thereby to search, exactions or contributions of any kind, provided in each case, and before beginning operations, notice is given to the nearest Custom House authority.

ARTICLE XXIX.

The government shall afford its protection in conformity with the laws of the Republic to the engineers, contractors, employés and laborers that may be engaged in the preliminary surveys or in the works of construction and operation of the canal.

ARTICLE XXX.

The association shall be exempt from all forced loans and military exactions, whether in time of peace or of war. The foreign agents and employés shall also be exempt from direct taxes, forced loans, and military exactions during the time in which they are in the service of the canal, but they shall pay the direct taxes established by law in case they may become owners of real property, or commercial or industrial establishments.

ARTICLE XXXI.

The association may freely introduce into the lands granted to it employés and laborers of every race who may be needed in its works and workshops; and it may also introduce immigrants of all nationalities excepting Asiatics and negroes. Both the immigrants and the employés and laborers shall be subject to the laws of the Republic and to the regulations of the company. The government assures them aid and protection and the enjoyment of their rights and guarantees in conformity with the constitution and the national laws during the time that they may remain within Costa Rican territory.

ARTICLE XXXII.

The Government of Costa Rica shall assure the association and its agents, under the laws of the Republic as it does to the other inhabitants, the full enjoyment of the guarantees and rights which the constitution and laws grant to them. Reciprocally the association and its agents bind themselves strictly to respect the laws and regulations in force in Costa Rica and especially to comply with the final decisions of the Courts, without considering themselves vested with other rights than those granted by law to Costa Rican citizens.

ARTICLE XXXIII.

The government shall establish all along the line of the canal which may be within the territory of Costa Rica or along its frontier, or in the waters appertaining to it in ownership or joint jurisdiction such police stations and revenue offices as in its judgment, may be necessary for the preservation of order in the region of the canal and for the observance of the fiscal laws of the Republic.

The expenses incident to said services including those of buildings, salaries, wages, and allowances of the employés and transportation of the forces and which may be in excess of such as are now borne by the Government for the Custom House actually established at the mouth of the San Carlos, or on any other point that may be crossed by the canal, shall be paid to the Public Treasury by the company on such terms and conditions as may be established hereafter, taking into consideration the requirements and necessities of such services.

The association shall also have the right to establish guards and watchmen for the service of the canal and the enforcement of its regulations.

ARTICLE XXXIV.

All contracts in regard to the works of the canal that the association may enter into in foreign countries shall be valid and effective, and shall have full force and effect in Costa Rica, provided they do not violate the laws of the Republic.

ARTICLE XXXV.

The association shall be exempt during the period of this concession, both in time of peace and in time of war, from all kinds of taxes upon the real estate that it may acquire by virtue of this contract, and from all kinds of direct taxes, local charges, or any other imposts relating to the property and use of the canal, or of its buildings and the construction and dependencies thereof, all along its extent, including those situated in the ports and maritime establishments on the two oceans.

This franchise is not transferable to the purchasers of the real estate which the association may alienate under this grant.

ARTICLE XXXVI.

The Republic of Costa Rica shall not establish any tonnage, anchorage, pilot or light-house dues, or any other charges of any kind whatsoever, upon vessels of any class whatever, or upon the merchandise, baggage and passengers which may pass through the canal from one ocean to the other; all such dues are reserved for the benefit of the association, as provided in Article 29.

ARTICLE XXXVII.

For the purpose of securing the most ample liberty or the transit of persons and property, a free zone shall be established on each side of the canal, and the width thereof shall be 90 metres and 288 millimetres, measured from the water's edge in the canal.

All traffic declared illegal by the laws of the Republic shall, however, be prohibited within the said zone, and the revenue authorities whose duty it is to watch for and prevent smuggling, shall act in conformity with the stipulations of Article 28.

It is expressly agreed that every vessel that may pass through the part of the canal which may be within the territory of Costa Rica, or along its borders or in waters over which it exerts co jurisdiction, shall carry on board an officer appointed by the Government whenever the authorities may deem it convenient, and that officer shall act in conformity with the law should he discover that it is being violated.

The two ports to be constructed for the entrance and exit of the canal on both oceans, which may be wholly or in part within the territory or in waters of Costa Rica, shall be declared free ports, and shall be recognized as such from the opening of the canal to the end of this concession.

The Government, in agreement with the company, shall establish, by means of a special decree, the limits of this franchise, which shall never extend beyond the waters of the ports comprised between the mouth of the canal and the entrance of said ports.

All merchandise that shall be loaded or discharged at any point of the canal within the territory of Costa Rica, and intended for internal commerce, shall pay the import and export duties fixed by the revenue laws of the State.

ARTICLE XXXVIII.

For the proper administration of the canal and its dependencies, and in order to facilitate its construction and operation, the association shall establish the proper regulations, which shall be binding upon every person who may be found in its waters or in its dependencies; the sole reservation being that the rights and sovereignty of the State be respected.

It is understood that the association, in the exercise of the powers conferred by this article, shall not make other regulations than those necessary for the administration and particular management of the canal: and that before carrying them into effect, they shall be submitted for the approval of the Government. The State shall lend the aid of its authority to enforce these regulations.

ARTICLE XXXIX.

By way of compensation for the expenses incurred in the surveys, construction, maintenance and operation of the canal, or any part thereof, during the period of said privilege, the said association shall have the right to establish and collect for the passage of all kinds of ships, vessels, travelers and merchandise through the canal, and in the waters and ports pertaining to it, such dues of navigation, tonnage, pilotage, towage, stowage, lay days, anchorage, light, roadsteads, wharfage, hospital dues and any other similar charges, in conformity with the tariffs to be established by it in accordance with Article 45 of this contract.

These tariffs may be modified by the association at any time on condition that all modifications that may be introduced in it shall be previously communicated to the Government, which, in case of finding them within the limits established by said Article 45, shall cause them to be complied with as if they were regulations enacted by itself.

The payment of all the tariff dues shall be exacted without any exception or preference, and under identical conditions, from all vessels, whatever be the place they come from or their nationality, with the exception stipulated in the following Article.

ARTICLE XL.

In compensation for the privileges and concessions that Costa Rica grants by this contract, it is hereby stipulated that the Republic shall enjoy the special privilege that Costa Rican vessels, navigating under the flag of Costa Rica, shall be entitled to navigate the canal at a reduction of fifty per centum of the general tariff while engaged in the coasting trade, or in the reciprocal trade with the other republics of Central America.

To enjoy this privilege, the said vessels shall be necessarily of the register of the Republic, and belong to citizens of the same.

A reduction of fifty per centum of the general tariff is also granted to all vessels that begin their voyage for a foreign country at any of the ports belonging to the Republic, with a cargo wholly consisting of products of the country.

Costa Rican vessels of war and revenue cutters shall pay no dues in passing through the canal. No dues shall be paid by the vessels of the National Register navigating either Costa Rican waters connected with the canal or the canal itself, without passing out of the locks, but said vessels are not in any way to obstruct the free navigation of the canal.

Costa Rica, on its part, shall not object to the enjoyment by Nicaraguan ships of the advantage granted in this article to those of Costa Rica, provided that Nicaragua, on its part, consents that the ships of Costa Rica shall enjoy in Nicaraguan waters the said privilege.

All the concessions to which this article refers shall be extended to the other Republics of Central America, or any of them, whenever Costa Rica and Nicaragua shall find themselves free from international obligations which may prevent it, or whenever one or more of said Republics shall form a single nation with Costa Rica.

ARTICLE XLI.

In case it may be possible to utilize the waters of the canal and its dependencies for the irrigation of plantations, gardens and streets, or for the supply of towns that may be without it, or as motive power for private enterprises, the company shall have the power to supply it, collecting dues in proportion to the amount furnished, according to the tariff that it may establish in agreement with the government.

ARTICLE XLII.

The association shall undertake at its expense the final surveys of the ground and the location of the line of the canal by a commission of competent engineers. The Government of Costa Rica shall have the right of visiting and inspecting the final surveys which are in progress, and those already completed by an engineer appointed by said government.

and whose salary shall be paid by the association, the amount thereof to be fixed hereafter by special agreement between the government and the company.

A period of two years and a half to be counted from the date of the ratification of the contract is granted the association for the final surveys of the canal, and within the said time the association shall have to make the said final surveys, organize the company, which is to carry on the work, and begin the work of construction.

The work of construction shall be understood to have commenced, if within three years after its inception, two millions of dollars have been expended on it.

The period herein provided for shall admit of extension by the republic at the request of the association, and upon grounds of justice, in the judgment of the government.

ARTICLE XLIII.

A term of ten years is also granted to the association for the construction, completion and opening to traffic the canal for maritime navigation. However, should events of main force arise duly justified, and sufficient to impede the regular progress of the works during the period of the said ten years, an extension shall be granted equal in duration to the time that may have been lost by such delays.

If at the expiration of the ten years aforesaid the works should not be completed, so as to have the maritime communication between the two oceans opened, in consideration of the great capital the company may have invested in the enterprise, and the good will and ability it may have shown, and the difficulties encountered, the republic binds itself to grant a new extension.

ARTICLE XLIV.

As a guaranty of the fulfillment of the obligations which the final company which is to construct the canal incurs in accordance with Article 42, it shall deposit to the order of the Government of Costa Rica, in a bank or in a mercantile house in this city, or with an agent which the government may designate immediately after the certificates are issued, one thousand shares of its capital stock of the nominal value of \$100 each. The said one thousand shares of capital stock shall be considered an advance to the government of the payment of the police and revenue expenses to be made under Article 33, and the association shall be credited with the actual value of said shares at the time such payments are made.

ARTICLE XLV.

In consideration of the valuable privileges, franchises and concessions granted by virtue of this contract to the association, the republic shall receive in shares, certificates or other values representing the capital stock of the final company, an amount equal to one and one-half per centum of the total amount of the issue of said capital stock in shares or certificates of \$100 each. This sum shall in no event be less than \$1,500,000. Said shares shall be considered as fully paid up, and two-thirds thereof shall not be transferable. All these shares shall participate in the benefits, interests, distributions, dividends, amortizations, rights, privileges, and all other advantages granted to paid-up shares without any difference whatever. These shares together with the other privileges herein granted by the association to the government shall be in full compensation to the republic for all public unappropriated lands that may be flooded and for all the privileges, and concessions conferred by this contract, and shall cover completely all claims of this description on the part of the State against the association or the final company. The shares to which this Article refers shall be delivered to the agent appointed by the government for this purpose as soon as the company may be ready to issue certificates of its capital.

ARTICLE XLVI.

From the earnings of the enterprise the company shall take, in the first place, the necessary amount to cover all the expenses for maintenance, operation and administration; all the sums necessary to secure the interest, which shall not exceed six per centum, and the amortization of the obligations and of the shares, and what remains shall form

the net profits, of which at least eighty per centum (80 per cent.) shall be divided among the shareholders, it being understood that after the lapse of ten years after the completion of the canal the company shall in no case divide among the shareholders in payment of dividends, directly or indirectly, by issue of shares or otherwise, more than fifteen per centum (15 per cent.) annually or in this proportion, from dues collected from the aforesaid canal and where it shall appear that these dues yield a greater profit, they shall be reduced to the fixed limit of fifteen per cent. per annum.

ARTICLE XLVII.

The present concession shall be forfeited:

1st. Through the failure on the part of the company to comply with any one of the conditions contained in Articles VII., XLII. and XLIII.

2d. If the service of the canal, after it is completed, is interrupted for six months, unless in case of unforeseen accidents or main force.

When the concession shall have been declared forfeited from whichever of these causes, the public lands granted by virtue of the present contract shall revert to the republic in whatever condition they may be, and without compensation, such lands as may have been alienated by the company with the formalities prescribed by law, shall be excepted, provided that such alienations shall not have taken place within the six months preceding the date on which the company may have become legally liable to the penalty herein established.

ARTICLE XLVIII.

At the expiration of the ninety-nine years stipulated in this concession, or in the event of the forfeiture expressed in the preceding Article, the republic shall enter into the possession in perpetuity of that part of the canal, its warehouses, stations and other establishments used for the management thereof, that may be found within the national territory. Such works as may be found in waters in which the republic has joint sovereignty shall belong to her in joint ownership. And in regard to such parts of the canal or of the waters thereof in which Costa Rica has not the eminent domain, but simply the right of use and free navigation, the republic, at the expiration of the ninety-nine years, or in the cases of forfeiture above named, shall retain in perpetuity the said rights of use and free navigation. The republic shall not be obliged to pay to the company any compensation for the same.

There shall be excepted from this condition the vessels belonging to the company, its stores of coal and other materials, its mechanical workshops, its floating capital and reserve fund, and at the expiration of the said ninety-nine years, also the lands ceded to it by the State under the present contract, excepting those in which the works indicated in the first part of this article may be found established, which will become the property of the State, with their immediate dependencies as necessary for the service of the canal and an integral part of the same.

But the company shall have the right, at the expiration of the aforesaid term of ninety-nine years, to the full enjoyment and a free use and control of the canal, and such parts thereof as may be within the territory of Costa Rica, with all the privileges and advantages granted by this concession in the capacity of lessee for a second period of ninety-nine years, upon payment to the government of Costa Rica of six and one-quarter per centum of the annual net profits of the enterprise, besides the dividends due to it for its share in the capital stock.

The company shall have the right to fix at its discretion the dues referred to in Article 39 of this concession, so that the shareholders, after the payment of 81 1-4 per cent. is deducted, shall still receive dividends of ten per cent. per annum on the whole capital.

At the expiration of this second period of ninety-nine years, the government shall enter into perpetual possession of the canal and the other property referred to in the first part of this article; and this delivery shall also embrace everything excluded in the said first part except the lands ceded to the association by this contract, and the reserve and sinking fund.

The failure to comply with any of the conditions of the lease shall terminate it, and the State shall enter into the possession of the part of the canal which corresponds to it, owing to it being situated in Costa Rican territory or in the places in which Costa Rica is joint owner, and also of the other works which belong to the canal in accordance with the provisions of the preceding paragraph.

ARTICLE XLIX.

Any misunderstanding that may arise between the republic and the company in regard to the interpretation of the present stipulations shall be submitted to a Court of Arbitrators, composed of four members, two of whom shall be appointed by the State and two by the company.

These arbitrators shall be designated by each party within the period of four months from the day on which one of them shall give notice to the other in writing of the want of agreement on the point at issue. Should one of the parties allow this period to lapse it shall be considered as assenting to the opinion or claim of the other.

The majority of the votes of the arbitrators shall finally decide without resource. In case of a tie vote the arbitrators shall appoint, by mutual consent, a fifth person who shall decide, and in case of their default the respective parties will appoint him. If they cannot agree to such appointment they shall draw by lot the names of the diplomatic representatives accredited to Costa Rica, and the first one drawn out shall exercise the functions of the fifth arbitrator. He shall concur on one of the two opinions, and what may be so decided shall be final and without recourse of any kind. If the fifth arbitrator should fail, the second person drawn shall exercise these functions, and so on successively until the decision is reached.

Prior to the initiation of the work of opening the canal the government, in concurrence with the company, shall formulate a set of rules to be observed by the arbitrators in all matters relating to procedure.

All questions between the association and private parties residing in Costa Rica shall be determined by the ordinary Courts of Costa Rica in conformity with the legislation of the Republic. In matters pertaining to parties not residing in Costa Rica the rules of private international law shall be observed.

ARTICLE L.

This contract, after being approved by the Hon. General President of the Republic, shall be submitted to the supreme legislative power for the purpose that if they deem it convenient they should impart to it the necessary ratification, and in case such approval is not obtained, the Nicaragua Canal Association will be released from all the obligations to which it is bound by it. Such ratification or non-ratification shall be made within one hundred and twenty days from this date.

IN WITNESS WHEREOF, the undersigned have set their hands to four copies of the present contract, two for each party, in San José de Costa Rica, 31st July, 1888.

PEDRO PEREZ ZELEDON.
A. G. MENOCAL.

PALACE OF THE PRESIDENT,
SAN JOSÉ, July 31, 1888.

In consideration that the foregoing contract agrees with the instructions given for its celebration to the Honorable Secretary of State, who authorizes it, it is hereby approved in all its parts for the purpose that it may be submitted to the deliberation of the Constitutional Congress.

Countersigned by his Honor the President of the Republic.

PEREZ ZELEDON.

ARTICLE 2.—The contract to which the foregoing article refers is hereby exempted from the payment of stamp duties.

TO THE EXECUTIVE POWER.

Given in the Hall of Sessions of the National Palace in San José, on the 9th day of August 1888

A. ESQUIVEL.
President.

MANUEL J. JIMEN.
Secretary.

FELIX GONZALEZ,
Vice Secretary.

PRESIDENTIAL PALACE,
SAN JOSÉ, August 9, 1888.

Therefore. Be it executed.

BERNARDO SOTO.

The Secretary of State of the Department of Public Works.

MAXIMO FERNANDEZ.

APPENDIX IV.

DICKINSON-AYON TREATY OF FRIENDSHIP COMMERCE AND NAVIGATION.

*Concluded June 21st, 1867; ratifications exchanged at Granada, June 20, 1868;
proclaimed August 18, 1868,*

The United States of America and the Republic of Nicaragua, desiring to maintain and to improve the good understanding and the friendly relations which now happily exist between them, to promote the commerce of their citizens, and to make some mutual arrangement with respect to a communication between the Atlantic and Pacific oceans by the River San Juan and either or both the lakes of Nicaragua and Managua, or by any other route through the territories of Nicaragua, have agreed, for this purpose, to conclude a treaty of friendship, commerce and navigation, and have accordingly named as their respective plenipotentiaries, that is to say:

The President of the United States, Andrew B. Dickinson, Minister Resident and Extraordinary to Nicaragua; and his Excellency, the President of the Republic of Nicaragua, Señor Licenciado Don Tomás Ayon, Minister of Foreign Relations;

Who, after communicating to each other their full powers, found in due and proper form, have agreed upon the following articles:

ARTICLE I.

DECLARATION OF AMITY.

There shall be perpetual amity between the United States and their citizens on the one part and the Government of the Republic of Nicaragua and its citizens of the other.

ARTICLE II.

Freedom of commerce.
Coasting trade.

ARTICLE III.

Most favored nations.

ARTICLE IV.

No discrimination in duties and charges on exports and imports.

ARTICLE V.

No discrimination in tonnage duties.

ARTICLE VI.

No discrimination in duties on vessels.

ARTICLE VII.

Privileges of citizens of one nation in the territory of the other in business affairs.
Protection to persons and property.

ARTICLE VIII.

Privileges of citizens of one nation in the territory of the other.
Real estate.
Estates of deceased persons.

NOTE.—As Articles II. to XIII. inclusive of this treaty have no direct bearing upon the canal enterprise, their subjects only are here mentioned. See "Treaties and Conventions Concluded Between the United States of America and Foreign Powers," Government Printing Office, Washington, 1899.

BUILDING RAILROAD THROUGH SWAMP. CORDUROY WITH TIES AND RAILS LAID IN THE BACKGROUND.





LAKE NICARAGUA, OMETEPE AND MADERA.



DIAMOND DRILL BORING PARTY.

ARTICLE IX.

Intermarriage and holding property not to change national character.
Exemption from military service and contributions.
Property not to be taken without compensation.
Freedom of travel and intercourse.

ARTICLE X.

Consuls.
Most favored nation privileges accorded to Consuls.
Diplomatic agents and Consuls.

ARTICLE XI.

In case of unfriendly relation, citizens may remove property.

ARTICLE XII.

Privileges of citizens of one nation in the territory of the other.

ARTICLE XIII.

Refuge and asylum.

ARTICLE XIV.

The Republic of Nicaragua hereby grants to the United States, and to their citizens and property, the right of transit between the Atlantic and Pacific Oceans through the territory of that republic, on any route of communication, natural or artificial, whether by land or by water, which may now or hereafter exist or be constructed under the authority of Nicaragua, to be used and enjoyed in the same manner and upon equal terms, by both republics and their respective citizens, the Republic of Nicaragua, however, reserving its rights of sovereignty over the same.

ARTICLE XV.

The United States hereby agree to extend their protection to all such routes of communication as aforesaid, and to guarantee the neutrality and innocent use of the same. They also agree to employ their influence with other nations to induce them to guarantee such neutrality and protection.

And the Republic of Nicaragua, on its part, undertakes to establish one free port at each extremity of one of the aforesaid routes of communication between the Atlantic and Pacific Oceans. At these ports no tonnage or other duties shall be imposed or levied by the Government of Nicaragua on the vessels of the United States, or on any effects or merchandise belonging to citizens or subjects of the United States, or upon the vessels or effects of any other country intended, bona fide, for transit across the said routes of communication, and not for consumption within the Republic of Nicaragua. The United States shall also be at liberty, on giving notice to the government or authorities of Nicaragua, to carry troops and munitions of war in their own vessels, or otherwise, to either of said free ports, and shall be entitled to their conveyance between them without obstruction by said government or authorities, and without any charges or tolls whatever for their transportation on either of said routes: *Provided*, said troops and munitions of war are not intended to be employed against Central American nations friendly to Nicaragua. And no higher or other charges or tolls shall be imposed on the conveyance or transit of persons and property of citizens or subjects of the United States, or of any other country, across the said routes of communication, than are or may be imposed on the persons and property of citizens of Nicaragua.

And the Republic of Nicaragua concedes the right of the Postmaster-General of the United States to enter into contracts with any individuals or companies to transport the mails of the United States along the said routes of communication, or along any other routes across the Isthmus, in its discretion, in closed bags, the contents of which may not be intended for distribution within the said republic, free from the imposition of all taxes

or duties by the Government of Nicaragua; but this liberty is not to be construed so as to permit such individuals or companies, by virtue of this right to transport the mails, to carry also passengers or freight.

ARTICLE XVI.

The Republic of Nicaragua agrees that, should it become necessary at any time to employ military forces for the security and protection of persons and property passing over any of the routes aforesaid, it will employ the requisite force for that purpose; but, upon failure to do this from any cause whatever, the Government of the United States may, with the consent or at the request of the Government of Nicaragua, or of the minister thereof at Washington, or of the competent legally appointed local authorities, civil or military, employ such force for this and for no other purpose; and when, in the opinion of the Government of Nicaragua, the necessity ceases, such force shall be immediately withdrawn.

In the exceptional case, however, of unforeseen or imminent danger to the lives or property of citizens of the United States, the forces of said republic are authorized to act for their protection without such consent having been previously obtained.

But no duty or power imposed upon or conceded to the United States by the provisions of this article shall be performed or exercised except by authority and in pursuance of laws of Congress hereafter enacted. It being understood that such laws shall not affect the protection and guarantee of the neutrality of the routes of transit, nor the obligation to withdraw the troops which may be disembarked in Nicaragua directly that, in the judgment of the government of the republic, they should no longer be necessary, nor in any manner bring about new obligations on Nicaragua, nor alter her rights in virtue of the present treaty.

ARTICLE XVII.

It is understood, however, that the United States, in according protection to such routes of communication, and guaranteeing their neutrality and security, always intend that the protection and guarantee are granted conditionally, and may be withdrawn if the United States should deem that the persons or company undertaking or managing the same adopt or establish such regulations concerning the traffic thereupon as are contrary to the spirit and intention of this treaty, either by making unfair discriminations in favor of the commerce of any country or countries over the commerce of any other country or countries, or by imposing oppressive exactions or unreasonable tolls upon mails, passengers, vessels, goods, wares, merchandise, or other articles. The aforesaid protection and guarantee shall not, however, be withdrawn by the United States without first giving six months' notice to the Republic of Nicaragua.

ARTICLE XVIII.

And it is further agreed and understood that in any grants or contracts which may hereafter be made or entered into by the Government of Nicaragua, having reference to the inter-oceanic routes above referred to, or either of them, the rights and privileges granted by this treaty to the government and citizens of the United States shall be fully protected and reserved. And if any such grants or contracts now exist, of a valid character, it is further understood that the guarantee and protection of the United States, stipulated in Article XV of this treaty, shall be held inoperative and void until the holders of such grants and contracts shall recognize the concessions made in this treaty to the government and citizens of the United States with respect to such inter-oceanic routes, or either of them, and shall agree to observe and be governed by these concessions as fully as if they had been embraced in their original grants or contracts; after which recognition and agreement said guarantee and protection shall be in full force: provided, that nothing herein contained shall be construed either to affirm or to deny the validity of the said contracts.

ARTICLE XIX.

After ten years from the completion of a railroad, or any other route of communication through the territory of Nicaragua from the Atlantic to the Pacific Ocean, no company which may have constructed or be in possession of the same shall ever divide, directly or indirectly, by the issue of new stock, the payment of dividends or otherwise, more than fifteen per cent. per annum, or at that rate, to its stockholders from tolls collected thereupon; but whenever the tolls shall be found to yield a larger profit than this, they shall be reduced to the standard of fifteen per cent. per annum.

ARTICLE XX.

DURATION OF TREATY.

The two high contracting parties, desiring to make this treaty as durable as possible, agree that this treaty shall remain in full force for the term of fifteen years from the day of the exchange of the ratifications; and either party shall have the right to notify the other of its intention to terminate, alter, or reform this treaty, at least twelve months before the expiration of the fifteen years; if no such notice be given, then this treaty shall continue binding beyond the said time, and until twelve months shall have elapsed from the day on which one of the parties shall notify the other of its intention to alter, reform or abrogate this treaty.

ARTICLE XXI.

RATIFICATIONS.

The present treaty shall be ratified, and the ratifications exchanged at the city of Managua, within one year, or sooner, if possible.

In faith whereof, the respective Plenipotentiaries have signed the same, and affixed thereto their respective seals.

Done at the city of Managua, this twenty-first day of June, in the year of Our Lord one thousand eight hundred and sixty-seven.

[SEAL]

A. B. DICKINSON.

[SEAL]

TOMÁS AYON.

APPENDIX V.

TREATY* BETWEEN THE UNITED STATES AND THE REPUBLIC OF NICARAGUA PROVIDING FOR THE CONSTRUCTION OF AN INTER-OCEANIC CANAL ACROSS THE TERRITORY OF NICARAGUA.

The United States of America and the Republic of Nicaragua, recognizing the importance of an Inter-oceanic communication across the Isthmus at Nicaragua, which shall bring into close communication the ports of North and South America and shall facilitate commerce between Europe and the ports of the Pacific, between the Eastern parts of Asia and the Atlantic seaboard, and the ports of the United States on the Pacific and Atlantic, have agreed for this purpose to build a canal, and to that end to conclude a treaty, and have accordingly named as their respective plenipotentiaries the President of the United States, Frederick T. Frelinghuysen, Secretary of State of the United States of America, and the President of Nicaragua, General Joaquin Zavala, ex-President of the Republic of Nicaragua, who, after communicating to each other their full powers, found in due and proper form, have agreed upon the following articles:

ARTICLE I.

The canal shall be built by the United States of America, and owned by them and the Republic of Nicaragua, and managed as hereinafter provided.

ARTICLE II.

There shall be perpetual alliance between the United States of America and the Republic of Nicaragua, and the former agree to protect the integrity of the territory of the latter.

ARTICLE III.

FULL POWERS GIVEN TO THE UNITED STATES.

A practicable ship canal for vessels of the largest size commonly used in commerce, shall be begun by the United States, and be prosecuted to as speedy conclusion as circumstances may permit, subject to the limitation provided in Article XX. of this convention. This canal shall follow what may be decided to be the most available route from ocean to ocean, and the United States, in building the canal, shall enjoy the fullest liberty in its construction and in its location, and that of its dependencies, accessories and works, as well as in the selection of entrance ports, should it be found necessary or desirable to leave the bed of the San Juan River at any point, and to construct a lateral canal. The government of Nicaragua reserves the right to require the establishment of a lock communication for vessels of 6 feet draft and 160 feet length, between the lower part of the river and that part used for the canals, but the Government of Nicaragua will advise the United States of its wishes in this regard as soon as work shall be begun in the river; and it is expressly stipulated that Nicaragua alone shall be responsible for the maintenance and operation of this communication and for the navigable condition of the lower river.

ARTICLE IV.

For the purpose of carrying out this agreement, the Republic of Nicaragua agrees to give the United States free use of Lake Nicaragua; to furnish, free of cost, all the spaces necessary to the construction, maintenance, use and enjoyment of the canal and for any

*This treaty has never been officially published. It is reprinted from the *New York Tribune* of December 18, 1884.

probable future enlargement thereof, whether these spaces be upon the dry land, in the lakes and upon their islands, in the rivers and upon their islands, or at the ports and roadsteads of the two oceans, together with their surroundings and declivities, and all the spaces required for the deposit of material from excavations and cuttings, from the overflows arising from dams in the rivers, for all deviations of streams from their channels, as well as for reservoirs, dikes, piers, docks, spaces about locks, for lights, beacons, storehouses, machine shops, buildings, and for whatever other thing necessary, and, in short, all lands, waters and places within the Republic of Nicaragua required for the construction, maintenance, use and business of the canal, including a railway from one terminal of the canal to the other, substantially parallel to and near the bank of the canal and along the southern shore of Lake Nicaragua, together with a telegraph line, should the United States decide to construct either said railway or telegraph line, or both, which shall be regarded for all purposes of this treaty as part of the canal so long as they are maintained.

ARTICLE V.

The work shall be declared one of public utility, and for the purposes of building and operating the canal, railway and telegraph line the Republic of Nicaragua undertakes to expropriate lands belonging to individuals. Any private property and real estate actually held by individuals or corporations which shall be taken or used by the United States for the construction of the canal or its accessories, or for their maintenance, shall be so taken upon condemnation and appraisal of the value of such property, and the Government of the United States will pay to the owners thereof the value fixed by a commission of assessors, comprising three members, one of whom shall be appointed by the President of the United States, one by the President of Nicaragua and the third to be chosen by these two jointly. The United States or the Board of Managers hereafter provided for, as the case may be, shall have the right to take from the public lands of Nicaragua any materials whatever needed for the construction, preservation, maintenance, and use of the canal and of its ports, dependencies, accessories and equipments. When the materials are taken from private lands the United States, or the said Board of Managers, shall enjoy in their use all the rights the Republic of Nicaragua enjoys by law and usage. As to the contract of the Government of Nicaragua with Mr. F. A. Pellas relating to steam navigation, that government engages that said contract shall not be considered applicable to the necessary operations of either party to this convention in constructing or operating the canal or any part of it during the time the contract has yet to run, this exemption to include necessary canal work and transportation on Lake Nicaragua and the rivers of the republic. Further, the said Government of Nicaragua agrees that, should the Government of the United States during the period the said contract has yet to run find it advisable to purchase the franchise, property and rights now held by said Pellas by virtue of said contract, the said franchise, property and rights shall be expropriated by the same form and under the same conditions as are fixed in this article for the expropriation of other private property. Should the United States, in the construction of the said works, find it necessary to occupy any lands belonging to the Republic, they shall have the right to do so free of charge during such temporary occupation, and the land so occupied, if sold or otherwise alienated, shall be conveyed with the reservation of this temporary right of occupation by the United States.

ARTICLE VI.

The United States shall have the right throughout the extent of the canal, and of its accessories, dependencies and adjuncts, as well as its mouths at both oceans, and in the lake and river which the canal route may traverse, and that may be used in any manner in connection with the canal construction, to enter upon work of any kind whatsoever deemed necessary by the engineers for the construction of a safe, effective, durable and speedy route for the transit of vessels from ocean to ocean without let or hindrance of any kind from the government or people of the Republic of Nicaragua, and also for the construction of the said railway and telegraph line.

ARTICLE VII.

SETTING ASIDE LANDS.

A strip of territory two and one-half English miles in width, the middle of the strip to coincide with the centre line of the canal, and also a strip two and one-half miles wide around the southern end of the lake where the lake is used as a water course for the canal, as well as a strip two and one-half miles wide along the river, where the river is used as a part of the canal, shall be set aside for the work and owned by the two contracting parties, and where the railway and telegraph line aforesaid may of necessity pass beyond the bounds of such strip of land a plot one-half of a mile in width, whose centre line shall coincide with the railway outside of the belt reserved for the canal shall also be set aside and owned, and all the land in this Article referred to shall be subject to the agreement hereinbefore made as to lands, when owned by the State or by private individuals, necessarily used in the prosecution of the work; but the said lands in this Article described shall not include towns, villages or cities now in existence. In such case, only that part shall be considered as embraced in this article as is absolutely essential to the economical prosecution or administration of the work over these strips. In time of peace, Nicaragua shall exercise civil jurisdiction, and its inhabitants shall not in any way be considered as impaired in their rights as citizens of the republic.

ARTICLE VIII.

PROVISIONS AS TO VESSELS AND THEIR CARGOES.

No Custom House tolls, or other taxes or impositions of any sort or kind, shall be levied by the Government of Nicaragua upon any vessels passing the canal, their cargoes, stores, passengers, crews or baggage, or for unloading, loading, docking or repairing vessels, it being the intent of this agreement that vessels, their cargoes and passengers and crew shall pass the canal free of any charge other than that imposed upon them by the two Governments, in their capacities as owners of the work. Nicaragua may, however, provide a police system along the line of canal to keep the peace and to prevent smuggling into her territory, the reasonable cost of which, as approved from time to time by the Board of Managers, shall be a charge upon the revenues of the canal. The Board of Managers shall have the right to discharge and reload ships in transit, at such points as may be convenient, in order to make repairs or to lighten the vessel, to ship cargo, by reason of any cause rendering any of these acts necessary, or may tranship cargo without being subject to search, actions, duties, or taxes of any kind, but before beginning such operations notice thereof must be given to the nearest customs authority.

ARTICLE IX.

The Government of the Republic of Nicaragua, in conformity with the laws, shall lend its protection to the engineers, contractors, agents, employes and laborers employed in the construction, maintenance and management of the canal and its accessories, and they shall be wholly exempt from military requisitions and forced loans; but if any such persons shall acquire real estate outside of the strips provided for in Article VIII hereof, they shall be subject to the taxes fixed by law. The Government of Nicaragua guarantees to the canal and its accessories, and to its agents of all classes, security, under the laws of the country, against domestic acts of hostility in the same degree as in the case of other inhabitants, employing all its powers for their protection.

ARTICLE X.

FREE FROM TAXATION.

All contracts for the construction, maintenance and management of the canal and accessories may be enforced according to the laws of Nicaragua and the provisions of this convention.

ARTICLE XI.

The canal and its accessories and dependencies of every kind shall be exempt in peace and in war from every form of taxation upon real or personal property acquired in virtue of this convention, and from every form of direct or indirect taxation, contributions, local taxes or other dues in respect to the ownership and use of the canal and its accessories, or of the buildings or constructions or equipments or appliances appertaining thereto, or to the ports and maritime establishments thereof anywhere in the republic and upon the lands set aside for the purposes of the canal and its accessories. The Republic of Nicaragua binds itself not to establish tonnage dues, anchorage, light, wharf or pilot dues, or charges of any class whatsoever, upon vessels of whatever kind, or upon merchandise, or crews, or passengers, or gold, or silver, or diamonds, or anything traversing the canal, all such dues being for the benefit of the two governments in their capacity as joint owners and managers of the canal and its accessories; but merchandise, loaded or unloaded, in any part of the canal or its accessories, coming from or destined to Nicaragua and intended for sale, shall pay dues for exportation and importation fixed by the revenue laws of Nicaragua.

ARTICLE XII.

EXEMPTING MATERIALS FROM DUTY.

All articles necessary for the construction and repair of the canal and its accessories may be imported without duty or tax of any kind being laid thereon by the Government of Nicaragua, including such iron, steel, locomotives, cars, telegraph wires and instruments, tugs, dredges and vessels or other things as may at any time be used in the construction, improvement, prosecution or maintenance of the work, or in the maintenance or improvement of the same after its completion; and during the construction of the canal and its accessories, all supplies, whether personal or otherwise, except tobacco, spirits or wines, used by those engaged in the work, shall be free of any customs or other tax; but no such supplies shall be permitted to be sold to those not actually engaged in the work, or to be smuggled into or sold in the interior. All vessels in the service of the canal and its accessories, with their equipment and outfit, arriving at any port of Nicaragua from any point whatever, shall be free of all duties and port charges.

ARTICLE XIII.

For and in consideration of the preceding articles, the United States of America agree to furnish the money to build the said canal and its accessories, including, if found advisable, the said railway and telegraph lines, together with all docks, locks, machine-shops, annexes, machinery, feeders, etc., it being the intent of this agreement that the United States of America shall build and complete the canal and everything appertaining thereto, for the safe and speedy passage of the vessels hereinbefore described, and for through communication between ocean and ocean, and such loading and repairing as may be necessary, at their sole cost and without expense to the Government of Nicaragua.

ARTICLE XIV.

EXCLUSIVE CONTROL GIVEN TO THE UNITED STATES.

The United States shall have exclusive control of the construction of the canal and railway and telegraph line, if the same be built, and shall be invested with all the rights and powers necessary thereto. The management, care and protection of the canal and its accessories, including the said railway telegraph line, if built under the general supervision of the two governments, shall be entrusted to a board of managers, which shall consist of six members, three of whom shall be appointed by the President of the United States by and with the advice and consent of the Senate thereof, should the Senate be in session; or, should the Senate not be in session, the three members shall be appointed by the President subject to confirmation by the Senate at its next session; and three by the Republic of Nicaragua. Any vacancy which may occur among the members of the board appointed by the President of the United States shall be filled by the said President in the

manner provided in the United States for filling of vacant government offices; and any vacancy which may occur among the members of the board appointed by the President of Nicaragua shall be filled by the said President in the manner provided in Nicaragua for filling vacant government offices. This board shall be designated as soon as the canal is ready for traffic, and shall determine all questions by a majority vote. The chairman of the board shall be one of the members appointed by the President of the United States, and designated as chairman by him; and in case of a tie, the chairman shall have an additional vote. This board shall be entrusted with the general executive management of the canal and its accessories, including said railway and telegraph line when built, and of all matters relating to the maintenance or improvement thereof; shall fix the tolls and provide rules and regulations for the management thereof. Their action shall be, however, at all times subject to a joint direction by the Presidents of the two Republics, which they shall be bound implicitly to obey. The said board of managers shall have the right and power to levy and collect for steamers, ships and vessels of every class entering the canal or the ports at the canal entrances, and for passengers, merchandise and cargo of all kinds, transit, navigation, tonnage, light and port dues, as well as for towage, storage, anchorage, wharfage and hospital dues, and all other like fees. The Government of Nicaragua guarantees the enforcement of the regulations so adopted by the board of managers as if issued by the Government of Nicaragua. The tolls hereinbefore provided, shall be equal as to vessels of the parties hereto, and of all nations, except that vessels entirely owned and commanded by citizens of either one of the parties to this convention and engaged in its coasting may be favored. Nicaraguan vessels using a portion only of the canal shall pay proportionate tolls, and shall pay no tolls where the canal shall use any part of any existing navigable waterway.

ARTICLE XV.

The books and affairs of the said Board of Managers shall be subject to such inspection or examination as the President of either republic shall at any time direct. The Board of Managers shall, on the first days of January, April, July and October in each and every year, make to the President of each republic a full and complete report of their transactions during the preceding quarter, and the President of either republic may at any time call upon them for such other or further information as he may deem expedient. The Board of Managers shall appoint and remove all officers engaged upon the canal and its accessories, including the railway and telegraph line, and may make regulations for the appointment and removal of all subordinate employees.

ARTICLE XVI.

HOW THE REVENUES SHALL BE USED.

All the proceeds of the canal and its accessories, including the railway and telegraph line, shall be applied:

First. To the maintenance and improvement, if found necessary, of the works, including the salaries of the Board of Managers and all officers and other employed.

Second. The balance shall be paid to the two governments in the following proportions, viz.: To Nicaragua one-third, and to the United States two-thirds. Liquidation of the accounts of the Board of Managers and payment of the balances herein prescribed shall be effected quarterly on the first days of January, April, July and October in each and every year.

ARTICLE XVII.

The Government of Nicaragua grants to the United States during the construction of the canal and its accessories, and to the Board of Managers thereafter, the right to use any of the ports of the republic open to commerce as places of refuge for the vessels in the service of the canal and its accessories, or for any other vessels whatever having the right to pass the canal, and wishing to enter any of the said ports, and these vessels shall be free of all duties or charges of any kind on the part of the Republic of Nicaragua.

ARTICLE XVIII.

The United States frankly disavow any intention to in any way seek to impair the independent sovereignty of Nicaragua or to aggrandize themselves at the expense of that State or of any of her sister Republics in Central America; but, on the contrary, desire to strengthen the power of free Republics on this continent, and to promote and develop their prosperity and independence. Pursuant to this wish they have united with Nicaragua in the construction of this work which will be of advantage not only to the two nations most intimately concerned, but to all those with whom they are on terms of friendship.

ARTICLE XIX.

If, in virtue of any existing treaty between the Republic of Nicaragua and a third power, privileges or rights are stipulated in favor of such third power of an inter-oceanic transit way, which may not be compatible with the terms of the present convention, the Republic of Nicaragua engages to terminate such treaty in due form by giving to the said third power the stipulated notification within two months from the date of the exchange of the notification hereof; and if such treaty between Nicaragua and any third power contain no termination clause, the Republic of Nicaragua engages to procure its abrogation or modification so as not to conflict with the present compact, and the United States will use their good offices, if need be, to the end of effecting such abrogation or modification.

ARTICLE XX.

WHEN WORK ON THE CANAL WILL BE BEGUN.

The United States of America engage to begin effective work on the canal within two years from the exchange of ratifications of this treaty and to complete the canal within ten years after beginning it, in default of which this treaty shall become inoperative, *Provided, however,* That should there arise insuperable obstacles to retard the work during this time it shall be prolonged in proportion to the time lost by reason of such obstacles; *And Further,* if at the expiration of the said ten years the canal shall not be opened to commerce between the two oceans, then, in consideration of the large capital invested in the work, and of the good faith and ability shown as well as of the difficulties encountered, the Republic of Nicaragua binds itself to extend this period so far as is just and necessary.

ARTICLE XXI.

Any difficulties between the parties hereto shall be submitted to the arbitration of a friendly power, if one can be agreed upon, or, failing such agreement, each party shall request a friendly nation to name an arbitrator, and the arbitrators thus named shall select a third; the decision of the arbitrating power or a majority of the Board of Arbitrators, as the case may be, shall be final and conclusive.

ARTICLE XXII.

The United States will aid by their good offices, if desired, in securing the union of the five Central American Republics under one representative government, and the reorganization of the said republics in one nationality being accomplished, the Central American Republics shall have the same rights and bear the same obligations as Nicaragua has and bears by virtue of this treaty.

ARTICLE XXIII.

FINANCIAL AID FROM THE UNITED STATES.

It appearing that the financial condition of Nicaragua is prosperous, that the republic is without incumbrance of debt, and that the government finds it necessary to finish as soon as possible certain railways within the republic, to extend its telegraph line, and to improve the navigation of the River San Juan, which enterprises will be of aid to the canal and favorable to its speedy construction and successful operation, the government of the United States agrees to loan to the Government of Nicaragua the sum of \$4,000,000, to be

applied to the above enumerated projects. Of this amount \$1,000,000 shall be paid in the City of Washington within ninety days after the exchange of the ratifications of this convention, and the remaining \$3,000,000 in installments of \$500,000 each every six months thereafter until the amount shall have been paid, but the failure to pay any of these sums from accident or non-action of Congress at the exact dates herein specified, such payments being made thereafter in good faith, shall not be held as affecting in any way the other engagements of this convention.

The Government of Nicaragua agrees that the Government of the United States shall be credited with and receive the share of Nicaragua in the net revenues of the canal, to be applied to the payment of this loan until it shall have been entirely extinguished, with the interest thereon at three per centum per annum, from the dates when the several sums shall be received by Nicaragua, and the Republic of Nicaragua may vote yearly through its Congress an additional sum from the general revenues of the Republic to be applied to the payment of this loan and to aid in its speedy extinguishment; and further, the Government of Nicaragua assuming the repayment of said loan, binds itself to consider it until extinguished together with the interest thereon, as hereinbefore provided, as a lien upon all rights of Nicaragua in the canal, its accessories and appliances, this lien to continue until the repayment of the sum so advanced with the interest, but the repayment is not to be exacted until ten years after the said canal shall have been completed, and opened to commerce.

ARTICLE XXIV.

Neither of the parties to this convention shall sell, assign or otherwise alienate or suffer itself to be deprived of its or any part of its interest, right or property in or to the said canal, railway or telegraph line, should the same be built, or their or any other adjuncts or accessories, or any of the works or establishments pertaining thereto without the consent of the other manifested by legislative enactment.

ARTICLE XXV.

RATIFICATION OF THE TREATY.

This treaty is concluded subject to ratification by the proper constitutional authority of each party hereto, and to the legislation by the appropriate legislative bodies of each, which is necessary to carry it into effect. It shall be ratified as soon as possible, but within two years from this date, and the ratifications thereof shall be exchanged in the city of Washington within six months from the approval by the said legislative bodies of Nicaragua and of the United States of the present treaty. *In testimony whereof* the undersigned plenipotentiaries have hereunto affixed their hands and seals. Done in duplicate in the English and Spanish languages, in Washington this first day of December, in the year of our Lord, one thousand eight hundred and eighty-four.

FRED'K T. FRELINGHUYSEN, [SEAL]

JOAQU'N ZAVALA. [SEAL]

APPENDIX VI.

THE NICARAGUA CANAL.

BY SENATOR JOHN SHERMAN.

Republished by permission from The Forum for March, 1891.

No other measure of public policy now submitted to the people of the United States is of such wide-reaching importance as the proposed construction of the Nicaragua Canal, and it is the duty of the organs of public opinion to state the elements of the problem that it offers, so that their readers may intelligently judge whether the United States should aid in its execution, and, if so, to what extent and in what manner. Hitherto such questions as this have been hidden under the cloak of diplomacy; but now, by the action of the Senate in removing the injunction of secrecy from negotiations with foreign powers, this great measure is open to the inspection of the American people, and is submitted to their judgment.

By a treaty, signed on December 1, 1884, between the United States and the Republic of Nicaragua, provision was made for the construction by the United States of an inter-oceanic canal from the Atlantic to the Pacific, across the territory of that republic. It was sent to the Senate on December 10, 1884, accompanied by a message from President Arthur recommending its ratification in strong and earnest language; but it was not formally acted upon prior to the inauguration of President Cleveland, on March 4, 1885. Mr. Cleveland, a few days thereafter, formally withdrew the treaty from the consideration of the Senate, and, in his annual message to Congress, in December of that year, stated as his reason for so doing that it contained "propositions involving paramount privileges of ownership or right outside of our own territory, coupled with absolute and unlimited engagements to defend the territorial integrity of the state where such interests lie." He further said:

"Maintaining, as I do, the tenets of a line of precedents from Washington's day which proscribed entangling alliances with foreign states, I do not favor a policy of acquisition of new and distant territory, or the incorporation of remote interests with our own."

Subsequently, on April 25, 1887, the Republic of Nicaragua, deeply interested in the construction of the work, granted to a private association of citizens of the United States a concession of the right to build an inter-oceanic canal. A like concession was made by the Republic of Costa Rica, situated on the southern borders of the San Juan River and Lake Nicaragua. The association obtaining these concessions was incorporated by an act of Congress approved February 20, 1889, under the name of "The Maritime Canal Company of Nicaragua." It appears from the terms of these concessions that the Maritime Canal Company is invested with the clear and unquestionable right to construct the work proposed, to sell its stock and bonds for the funds required, and to seek the aid of foreign powers, especially that of the United States. The American company thus authorized and organized has supplemented the previous examinations and *reconnaissances* of officers of the army and navy of the United States by careful detailed instrumental surveys measurements, soundings, and estimates of cost; so that the precise work to be done and the difficulties to be overcome are known. This work has been revised by a board of consulting engineers, and, before any aid shall be rendered by the government, it is to be further revised by officers of the army and navy of the United States on whose skill and judgment entire reliance can be placed. The revised estimates place the cost of the work at \$78,176,308, to which is added for possible contingencies \$14,633,262; and to this must be added interest on the money invested during the progress of the work, making the aggregate cost

about \$100,000,000. The Maritime Company has entered upon the actual work of construction, and satisfactory progress has been made, so that the cost, location, and engineering problems involved are fully known. It is apparent that the physical difficulties to be overcome are not greater than those of many of the works of improvement undertaken within our own country, for the highest part of the water way is to be only 110 feet above the two oceans—a less altitude than that of the base of the hills which surround the city of Washington. The works proposed include a system of locks, similar in character to the one built by the United States at the falls of Sault Sainte Marie and to those constructed by Canada around the Falls of Niagara. A single dam across the San Juan River, 1,250 feet long and averaging 61 feet high, between two steep hills, will insure navigable waters of sufficient depth and width for the commerce of the world, for a length of 120 miles. The approaches to this level, though expensive, are not different from similar works, and will be singularly sheltered from floods and storms. Of the distance of 169.4 miles from ocean to ocean, 142.6 miles is to be accomplished by slack-water navigation in lake, river, and basins, and only 26.8 miles by excavated canal. The greatest altitude of the ridge which divides the water of Lake Nicaragua from the Pacific Ocean does not exceed at any point 43 feet above the lake.

Perhaps the chief engineering difficulty is in the construction of harbors at the Pacific and Atlantic termini of the canal; but that at Greytown, on the Atlantic coast, which is considered the most formidable, has already been partially built. Vessels requiring 14 feet of water can now safely enter this harbor and discharge their cargoes at the docks of the company. The obstacles are not to be compared with those encountered in the attempted construction of the Panama Canal, or with those which were easily overcome in the construction of the Suez Canal; and the whole work, from ocean to ocean, is free from the dangers of moving sand and destroying freshets. Lake Nicaragua itself is one of the most remarkable physical features of the world. It fills a cavity in the midst of a broken chain of mountains, whose height is reduced, at this point, nearly to the level of the sea, and it furnishes not only the means of navigation at a low altitude, but enormous advantages as a safe harbor.

Though the length of transit is greater than in the cases of the other routes proposed, the difficulties in the way are far less. These are disappearing as the work goes on, while the advantages which will be gained by the construction become more apparent, and can scarcely be measured. The first is one that will be, and ought to be, shared by the whole civilized world. The establishment of a water way between the Atlantic and the Pacific will realize the dream and hope of Columbus, who underestimating the circumference of the earth, started on his voyage for the coast of India, and found his way blocked by the newly-discovered continent. Since that time, for nearly four centuries, explorers have hoped to find some open way across the Isthmus, or, failing in that, to construct such way by artificial means. Every explorer and adventurer, every king and power, has shared in this hope, and to realize it many hazardous enterprises have been attempted. The Government of the United States, in later years, especially since the settlement of California, has felt the deepest interest in accomplishing this latter achievement, has sought by negotiation and by treaties to protect the region from hostile occupation, has joined in several plans to construct canals across the Isthmus, and has caused to be made elaborate and careful surveys, both by civil and by military engineers, with a view to the selection of the best route. Other nations have been equally interested, but not so active or effective in preparing the way and in selecting the location. The success of the Suez Canal led M. de Lesseps, who was the chief agent in the construction of that work, to seek to complete the channel of navigation around the world by a water way at Panama. The scheme contemplated the digging of a canal from sea to sea, partly at the level of tide water and partly below it. The work, thus far, has been a failure, and the plan is believed to be impracticable. The Nicaragua route, though burdened with the delays of lockage, is now conceded to be more practical, far less costly, and more useful, than the one at Panama, and will accomplish the same object.

The second great advantage to be derived from the construction of this canal, is the ex-

tension of our coast line through it to our western States and to neighboring countries. Vessels sailing from New York to San Francisco are now compelled to pass around Cape Horn, a distance of 19,000 miles. The benefits to be derived from this extension can scarcely be measured. The enormous quantities of wheat, lumber, and other articles produced on the Pacific coast can now be transported to the Atlantic States only by 8,000 miles of railway or by the long voyage around South America, so that the entire value of these productions is often consumed in the expense of the journey. It is believed that our coasting trade would be increased many fold by the use of the canal through Nicaragua, and that by its employment would be given to vessels at seasons of the year when they are now laid up in northern ports.

Another benefit to be derived by the United States from the construction of this canal is that it will give our people a community of interests with the western coasts of Mexico and South America, now substantially closed to our commerce. The commerce of these coasts, being compelled to go around Cape Horn, can from that point reach with less difficulty the markets of Europe than the markets of our own country; while, if the canal be constructed, there will be a safe, well-protected water-route between the western ports of the American continent and our chief commercial cities. The canal will, for the first time, make possible an enforcement of the Monroe Doctrine, hitherto a mere dogma in American policy. The communion of interests between the American States will be enormously strengthened by this work. The South American republics are patterned after ours; there can be no clashing of interests between us. For many years they are not likely to be manufacturing countries, but will be devoted mainly to agriculture and mining. They would naturally exchange their gold, silver, sugar, coffee, tropical fruits, guano, and other sources of wealth for the manufactures and productions of the United States.

The construction of this canal would seem, judging by statistics, to be a very profitable investment for American capital. The rapid accumulation of wealth in our country has removed us from among the nations that, by their means, are limited to home enterprises. Assuming that the estimate of tonnage is not excessive, and that the cost of the improvement will not exceed \$100,000,000, the smallest rate of tolls proposed by any one will yield at least five per cent. on the investment, as well as secure to our citizens, from their proximity to the work, great advantages of trade and profit over foreign competitors.

I will not enter into details as to the nature of the work, or as to the further benefits to be derived from its construction. The question remains, How shall it be executed? And this question must be solved, not in such a way as to advance the interests of private citizens or companies, but as to benefit all the people of the United States. It is proper for me to emphasize the fact that the Maritime Canal Company, and the Construction Company, organized by it, have made no application to Congress for aid. The Maritime Canal Company can, no doubt, by making great sacrifices of its stock and bonds, secure the completion of the canal; but all experience shows that this will involve an output of stock and bonds that will be a permanent charge and burden upon the commerce that passes through the canal. The Senate Committee on Foreign Relations has examined the officers of the Maritime Company as to their plans for raising money, which appear to be substantially the same as those adopted for other works of improvement constructed by private corporations. As no income or profit can be derived from the work until its completion, and until the actual passage of vessels through the entire length of the canal, the company, without aid from the government, would be obliged to rely upon its credit, or upon its own resources; and, under the most favorable circumstances, it is shown that the burden of liabilities upon the completed work would be not less than \$250,000,000, and might extend to \$400,000,000, most of the amount borrowed at a high rate of interest, accompanied by large discounts. The stock and bonds would have to be disposed of in the open market, and would be sold largely in Europe. Therefore, though the work would have been instituted and conducted by American citizens, the control and management of the corporation would necessarily drift into the hands of holders who have no regard to the important American interests involved in the enterprise. On the other hand, it is apparent that if the United States should aid the work by their credit, the Maritime Company would be able

to complete it at the estimated cost without discount or loss; and that, in consideration of this aid, the United States could prescribe such terms and conditions as would carry out the object of the concessions and the fixed policy of this government. Vessels of the United States will, in all probability, carry the chief commerce through the canal, and it is for the interest of our people that the charges on these vessels shall be so low as to induce the largest possible number of their owners to avail themselves of the benefits of the canal.

The question, then, before those who were drafting a bill to secure government aid, was in what way this aid should be rendered without involving a departure from our established policy as stated by Mr. Cleveland, and without pecuniary loss or entangling alliances. The only method that was suggested was the one adopted by other nations under like circumstances, and especially by Great Britain in respect to the Suez Canal, namely, that the government should, in consideration of its guarantee, secure such a control of the majority of the stock as to enable it to protect the interests of the people, and such control of the expenditures on the work as certainly to limit the obligations of the company to the actual cost of the canal in money. These primary objects have been, it is thought, secured in the bill now pending, by an unconditional guarantee of payment of the principal and interest of the bonds of the company; by the application of the proceeds of these bonds, under the direction of United States engineers, to the work actually done; and by the transfer of \$70,000,000 out of \$100,000,000 in stock to the United States, with the power to vote at any meeting of the company and with a proper representation on the board of directors. These, and other provisions of the bill reported, will, it is confidently believed, not only secure the completion of the work at cost, but will place it in the power of the United States to protect their citizens in the full rights conceded by Nicaragua and Costa Rica, and will prevent the management of the work from falling into the hands of men who are indifferent or hostile to American interests in that portion of the world.

These objects being secured, the question arose as to what arrangement should be made with the American citizens who had, when the United States declined to construct the work, obtained concessions, and who had actually entered upon its construction. The act of their incorporation provided that it might be altered, amended, or changed, at the pleasure of the United States; but the exercise of this power without regard to the interests of the incorporators, and without neglect or forfeiture on their part, would have been a breach of the public faith. The only result would have been that the government would have been compelled to undertake the work itself, or, by declining to do so, would have maintained the dog-in-the-manger policy of refusing to execute, or to allow any other power to execute, a work of conceded importance to all the nations of the world. At the same time the public naturally objects to the use of the credit or the money of the United States to advance the personal interests and profit of individuals. It was therefore provided that the promoters of the Nicaragua Canal should be reimbursed only for the actual cost to them of the work already done, and that this cost should be ascertained by proper officers of the government and paid in the bonds of the Maritime Company guaranteed by the United States. In addition, it was provided that the promoters should have such reasonable allotment of the stock that they already own by virtue of the concession granted to them, as would be a just and fair compensation for their vested rights and for their services. By the terms of the contract entered into by the Maritime Company with the Construction Company, the latter is entitled to \$12,000,000 in stock, in consideration for the concessions and privileges granted by Nicaragua and Costa Rica, which were transferred by the Construction Company to the Maritime Company. It was deemed, after careful consideration, that, as this stock has not yet been earned, the Maritime Company should be allowed to issue to the Construction Company stock of the former company to the value of \$3,000,000, upon condition that all other stock of the Maritime Company, of every kind, name, and nature, issued or agreed to be issued, should be surrendered and canceled, except \$8,000,000 stipulated to be given to Nicaragua for its concessions, and \$1,500,000 to be given to Costa Rica. The value of this stock at first would be nominal, and its future value would depend entirely upon the value of the completed work. This.

proviso is regarded by the Maritime and Construction Companies as harsh and illiberal, yet they have agreed to it, as well as to the other terms and conditions proposed in the pending bill.

The more I reflect upon the transcendent importance of the work proposed, upon the international difficulties which formerly surrounded the subject, upon the objections of a large portion of our citizens to the direct construction of the work by the United States according to the plan proposed by the treaty, and upon the just claims of the American promoters of this enterprise who have been engaged in it, the more I am convinced that the aid to be given by the United States, if the bill should become a law, would be a wise act of public policy, second in importance to no other in the history of our country, and of general benefit in promoting our commerce and industry in every section. No doubt the cities along the Gulf of Mexico and the southern Atlantic coast will first feel the beneficial effect of this improvement, but it will extend to the people of every State, by the increase of their commerce and productions.

To reject or to neglect the opportunity now offered would leave this enterprise to the chances of failure, or transfer its control to commercial rivals whose interests and fixed policy would lead them to convert a great highway of nations into a dependency more formidable than Gibraltar and more troublesome than Canada. A commercial company in India has been converted into a vast empire; the single port of Hong Kong is made to dominate a great population in China; the control of the Suez Canal and of Egypt has been purchased in the stock market—these are sufficient warnings to the American people to avail themselves of the opportunity now open to them to protect their coastwise trade, and at the same time, with little cost and no risk, to contribute to the world one of the greatest achievements of mind over matter that has ever been undertaken.

APPENDIX VII.

SPEECH

OF

HON. JOHN. T. MORGAN,

IN THE

UNITED STATES SENATE.

Mr. MORGAN. I call up the bill (S. 4827) to amend the act entitled "An Act to incorporate the Maritime Canal Company of Nicaragua," approved February 20, 1889; and I ask that it be read.

The Bill was read, as follows:

Be it enacted, etc., That the capital stock of the Maritime Canal Company of Nicaragua shall consist of one million shares of \$100 each, and no more.

SEC. 2. That the words "the Nicaragua Canal," whenever used in this act, or the act to which this is an amendment, shall be held to include all railroads, piers, channels, dams, locks, embankments, and other works necessary for or incidental to the construction, equipment, maintenance, and operation of the said inter-oceanic canal, made or that may be made by the Maritime Canal Company of Nicaragua, or under its authority, by virtue of the said acts and the concessions granted or to be granted by Nicaragua and Costa Rica.

SEC. 3. That in consideration of the provisions of this act all the stock of the Maritime Canal Company of Nicaragua, heretofore subscribed for or issued, except as in this act provided, and all contracts and agreements heretofore made not consistent with the provisions of this act shall be made to conform therewith or be canceled, and the stock of said company shall only be disposed of as hereinafter provided, it being the intent and object of this act to secure the construction of the Nicaragua Canal by the said company, with the aid of the United States to the extent herein provided, upon the basis of the concessions of Nicaragua and Costa Rica, and the contracts and engagements heretofore made consistent with the provisions of this act or that may hereafter be made by said Maritime Company consistent with the provisions of this act, and, as far as practicable, at its actual cost.

SEC. 4. That to secure the means to construct and complete said canal and to meet the expenditures made on account thereof the said Maritime Canal Company of Nicaragua is hereby authorized to issue either coupon or registered bonds, or both, of the said company, in denominations of not less than \$100 nor more than \$1,000, to an amount not exceeding \$100,000,000, to be dated on the first day of January, 1891, to be payable on the 1st day of January, 1911, with interest at the rate of 3 per cent. per annum, payable quarterly, on the 1st day of April, July, October and January of each year, from the delivery of the bonds to said company by the Secretary of the Treasury from time to time as in this act provided.

And said bonds shall be secured by a first mortgage on its property and rights of property now existing or hereafter acquired of all descriptions, real, personal and mixed, and including all concessions, franchises, and rights of the said company. Such mortgage shall be so framed as to be valid as a first lien under the laws of Nicaragua and Costa Rica. The form and sufficiency of such mortgage as the first lien upon the Nicaragua Canal shall, before execution, be approved by the Attorney-General of the United States, and the trustees named in such mortgage shall be approved by the Secretary of the Treasury; and such mortgage shall be duly executed in triplicate by the officers of said company. And such

mortgage shall be recorded in the office of the Secretary of the Treasury in Washington and in the proper offices in Nicaragua and Costa Rica, to be designated by the Government of each of said States.

SEC. 5. That the said mortgage bonds shall be prepared, engraved, and printed at the Bureau of Engraving and Printing, in the City of Washington, at the expense of said Maritime Canal Company of Nicaragua, and, after being duly executed by the officers of said company, shall be deposited in the Treasury of the United States at Washington, and shall be issued by the Secretary of the Treasury from time to time to the said Maritime Canal Company of Nicaragua only as the work on the Nicaragua Canal progresses, as hereinafter provided.

Before the issue of said bonds by the Secretary of the Treasury he shall cause to be engraved and printed and duly executed on each of said bonds the guaranty of the United States, in accordance with such regulations as may be prescribed by the President of the United States, in the words and figures following, to wit:

"The United States of America guaranties to the lawful holder of this bond the payment by the Maritime Canal Company of Nicaragua of the principal of said bond and the interest accruing thereon, and as it accrues.

And no bonds shall be issued by the said company except as provided for in this act.

And the Secretary of the Treasury is hereby authorized and directed, if the interest on said bonds as it becomes due is not paid by the Maritime Canal Company of Nicaragua, to pay the same, and the sum required for that purpose is hereby appropriated out of any money in the Treasury not otherwise appropriated.

The Maritime Canal Company of Nicaragua, shall pay the interest on the guaranteed bonds herein provided for as it becomes due, and the guaranty of the United States shall not be held or construed as lessening the liability of said company as the principal obligor in said bonds. Upon the failure of said company to pay the interest as it becomes due on said bonds and upon the payment of such interest by the United States, the said company shall pay to the United States the amounts paid by the United States on such guaranty, with interest annually at 4 per cent. until paid.

SEC. 6. That for all sums of money that the United States may pay upon the principal or interest of said bonds under their said guaranty the United States shall be subrogated to all the rights and liens under the said mortgage which the holders of said bonds or any of them would have had in respect thereof if the same had remained unpaid by the Maritime Canal Company of Nicaragua and had not been paid by the United States under their guaranty; but until the expiration of five years after the said canal shall be put in operation and so long as during said five years the canal shall be in operation and remain under the control of the Maritime Canal Company of Nicaragua, this subrogated lien and right of the United States as aforesaid shall not be enforced by foreclosure or otherwise of the said mortgage against the property covered by said mortgage.

SEC. 7. That as soon as practicable after the passage of this act the surrender and cancellation of the stock, and the cancellation or modification of all contracts and agreements of said company for the construction of said canal, as provided for in Section 3 of this act, the Secretary of the Treasury shall deliver to the Maritime Canal Company of Nicaragua bonds of the said company guaranteed as aforesaid at the par value thereof, to an amount equal to the amount expended by said company and the Nicaragua Canal Association prior to the 1st day of January, 1891, in securing concessions from Nicaragua and Costa Rica, in promoting the enterprise and in the construction of said canal, including the expenditures for the plant of the Nicaragua Canal Construction Company, if transferred to the Maritime Canal Company, together with interest on such amounts from the date of payment not exceeding the total amount of \$4,000,000. The Secretary of the Treasury shall also, as soon as practicable after the passage of this act, deliver to the Maritime Canal Company of Nicaragua bonds of the said company guaranteed as aforesaid at the par value thereof to an amount equal to the amount of money which shall be actually paid out and expended by said company in the construction of said canal from and including the 1st day of January, 1891, to the final adjustment of the account, with interest thereon at

the rate of 6 per cent. per annum: *Provided*, That all such amounts, both of moneys expended prior to January 1, 1891, and subsequently thereto, shall be ascertained to the satisfaction of the Secretary of State and Secretary of the Treasury upon accounts to be rendered by said company. Said bonds shall be received and applied by said company and the stockholders in full payment and satisfaction for any and all expenditures heretofore made or to be made and in satisfaction of all liabilities, including issues and agreements to issue stock and bonds of said company to be recalled and canceled or modified, as provided for in this act, incurred prior to such adjustment, in the construction of said canal, the promotion of the enterprise in securing such concessions, and for all property acquired, material furnished, services rendered, and work performed. The performance of such conditions shall be ascertained by the Secretary of the Treasury prior to the delivery of such bonds.

SEC. 8. That the President of the United States is hereby authorized and directed to cause a careful detailed estimate and statement to be made, as soon as may be, of the cost of the Nicaragua Canal as proposed to be constructed and completed according to the plans and specifications of the Maritime Canal Company of Nicaragua, including in such estimate reasonable costs of administration and the interest accruing on the bonds herein provided for prior to the 1st day of January, 1897. And the President shall, within sixty days after the passage of this act and from time to time thereafter and as frequently as once in sixty days, cause an estimate and statement to be made of the cost of the work actually done on said canal, including reasonable costs of administration, since the 1st of December, 1890, or the last preceding estimate, and thereupon the Secretary of the Treasury shall deliver to said Maritime Canal Company of Nicaragua the bonds of the said company guaranteed as aforesaid, to the amount of such cost and also interest to become due before the next estimate; but the total amount of such bonds to be delivered shall not exceed the cost of said canal; and the proceeds of all said bonds so far as necessary shall be wholly applied in payment of the cost of the construction of such canal and reasonable expenses of administration and accrued interest upon the outstanding bonds of the company, and shall not be sold or disposed of at less than par.

A sum or sums necessary to pay the expense of making the estimates provided for in this section is hereby appropriated out of any money in the Treasury not otherwise appropriated.

SEC. 9. That to secure to the Governments of Nicaragua and Costa Rica the benefits stipulated by their concessions, and to indemnify and save the United States harmless from its guaranty of the bonds of the said Maritime Canal Company of Nicaragua, the stock of the said company, by this act limited to \$100,000,000, shall be issued only as follows:

First. An amount of the stock which at the face or par value thereof shall, with the amount of the bonds at their par value, to be issued to the Nicaragua Canal Company for expenditures by it prior to January 1, 1891, as provided for in Section 7 of this act, make an aggregate of \$7,000,000, may be retained by the said canal company and the stockholders thereof, and shall be non-assessable.

Second. The amounts of shares stipulated to be delivered to the Governments of Nicaragua and Costa Rica, according to the terms of their respective concessions.

Third. The amount of \$70,000,000 of shares to be issued to, and in the name of, the Secretary of the Treasury of the United States, in such certificates as he may prescribe, to be held in the Treasury as a pledge and security to the United States for the repayment to the United States, on demand, of any sum or sums paid by it in pursuance of its guaranty on said bonds, with interest on the sums so paid from the date of payment at the rate of — per cent. per annum, payable annually; and the Secretary of the Treasury, on behalf of the United States, may at his discretion vote said stock, either in person or by proxy, at any meeting of the stockholders of said company, and the United States shall, at any time before the maturity of such bonds, have the option, at the discretion of Congress, to purchase at par value or subscribe for and hold in its own right all or any part of said stock so hypothecated. And the United States may apply in payment for such stock the sums

paid by the United States by reason of said guaranty and the interest thereon, and the remainder of the purchase price of said stock shall be applied, according to the discretion of Congress, either to the purchase and redemption of the bonds of said company, or for a sinking fund for the purchase and redemption of such bonds at maturity, or for both of these purposes.

Fourth. The rest and residue of the stock shall only be issued by the Maritime Canal Company of Nicaragua after the same shall have been subscribed for, and such stock shall only be offered by the company for subscription when, in the opinion of the President of the United States, the proceeds of the installments of the mortgage bonds herein provided for shall be insufficient to meet the current requirements of the company in respect to the enterprise.

SEC. 10. That to secure the proper application of the aid to be furnished by the United States by this act, Section 4 of the act approved February 20, 1889, entitled "An act to incorporate the Maritime Canal Company of Nicaragua," is so amended that six of the fifteen directors of said company shall be appointed by the President of the United States, by and with the advice and consent of the Senate, two of whom shall hold office for two years, two for four years, and two for six years, as may be designated in their appointments, and their successors shall hold office for six years. And such government directors shall not be stockholders of said company, and shall report direct to the President of the United States. And all parts of said act approved February 20, 1889, inconsistent with this act are hereby repealed.

SEC. 11. That all the rights and powers reserved to Congress by Section 8 of the act to which this is an amendment are hereby reserved and re-enacted, and shall apply also to this act.

MR. MORGAN.—Mr. President, the bill which has just been read to the Senate has a support from every section of the country that gives to it a broad, national character. Maine, Vermont, and Oregon on the northern border, Louisiana, Alabama, and Georgia on the southern border, and Ohio and New York in the central body of States are represented on the committee, and give to it their earnest and united support.

Our distinguished colleague on the committee, the Senator from Georgia (Mr. Brown), has been detained from the Senate by ill health during the examination of this subject. He has, however, been fully informed of the facts that were under consideration and the measure proposed by the committee, and has authorized me to express his entire concurrence in the bill and report submitted to the Senate. The people understand his wise and conservative views on questions relating to public indebtedness and finance, and will be glad to know that this bill has the honorable Senator's earnest support. The people of the South especially have learned to value his opinions on all practical business questions.

The plan for aiding in the construction of the Maritime Canal of Nicaragua is new to the country, and has been recommended by the Committee on Foreign Relations, after the most careful consideration. I am not assuming to speak for the committee, but for myself and in the discharge of a duty to my own constituency, in presenting a statement of the facts and conditions that I think are imperative in their demand that I shall give my earnest support to this bill.

A sense of duty to the whole country scarcely less commanding also requires me to advocate this measure. I will not now detain the Senate by a statement of the careful examinations that have been made of the Isthmus of Darien with a view to ascertain the best route for a ship canal to connect the waters of the Atlantic and Pacific Oceans. Some of the transatlantic powers have been looking into this matter for more than three centuries, and it has been a matter of the deepest concern to the United States since our Government was ordained. The civilized world has united in the opinion that such a canal is practicable and that it will be constructed.

The time for its construction and the best location of the canal are matters that have been delayed as to their final determination by circumstances that are not quite easy of explanation, until the demands of the commerce and steam navigation of the world have

become impossible of longer denial. The opening of such a canal at some point on the Isthmus of Darien, following the opening of the Suez Canal, is as logically a necessity of the world's commerce as it is that the tides of oceans should be affected by the movements of the planetary systems.

As to our coastwise commerce the free passage of ships through this Isthmus at moderate charges on freights and passengers is as important to us as the navigation of the Mississippi and the lakes of the north are to our internal commerce. If all the plans and counterplots relating to the interests of the different nations in this great line of communication could be brought to light, we would discern two very important facts that have retarded the construction of such a canal: First, that all who have seriously contemplated this great work have been convinced that the work could not be accomplished as a private enterprise at a cost that the interests of commerce could tolerate; and, second, that the United States has never been willing that any transatlantic government should either construct or control this canal transit.

Our consent that England or France or Germany should construct and control the canal, wherever it might be located, that would cut the Isthmus of Darien, would long since have secured this great work to the world; but we never could consent to that.

The national power that controls the transit of ships across the Isthmus of Darien must necessarily be one of the greatest powers in the world in its influence on commerce and naval warfare.

It is a simple and inadequate illustration of the military feature of the subject to say that it requires two fleets, separated by 12,000 miles of sailing distance, to blockade one fleet of equal power to either in Lake Nicaragua. But, this doubling of the power of a fleet at anchor in Lake Nicaragua, over that of any other great maritime power that is moving across the Atlantic or the Pacific to attack our coasts, is but a small part of the strategic advantage of such a situation.

As a *point d'appui*, a foothold from which to attack or defend, to threaten or protect all the coasts of this hemisphere and the islands and adjacent seas, it is more a point of commanding power in the Atlantic and Pacific Oceans than Gibraltar is in the Mediterranean Sea. I do not now intend to elaborate this great matter, but to refer to it as a means of accounting for the jealousies of nations in respect of the control of this isthmian transit which has delayed the construction of a ship canal to connect the two great oceans.

An examination of our treaties with the local governments of Central America and with Great Britain discloses extreme solicitude on the part of all the governments about the ship transit across the Isthmus of Darien. We have been pressing our claims in the direction of securing our rights in the use of the canal, wherever it should be constructed, and have given guaranties of protection to the local governments against domestic strife that might endanger our commerce and that of other nations while in transit across the Isthmus, and we have also guarantied the sovereign right of the local governments to own and control a ship canal through the Isthmus, under certain conditions, against the interference of any foreign power.

But, in our dealings with Great Britain on the subject of our right as a great and influential power in America, and our more specific interests, rights, and duties, as the greatest commercial nation on the western hemisphere, we have found that government intent upon depriving us of our natural and legitimate influence over this transit for ships between the great oceans.

I will not now enter upon the discussion of the diplomatic arrangements by which this purpose has been, so far, accomplished, nor the humiliation that is felt by those Americans who have supported the theory of American rule in American affairs—the home rule of American people—that we call the Monroe doctrine, when they find that other Americans are willing to yield to Great Britain this ascendancy in the control of the domestic policies of American states.

That may now be a practical question, but there is but one American side to it. If it is a living question, it is also a burning one, and the sooner it is settled the better it will

be for all the world. But I refer to it now only to emphasize the fact that this transit for ships across the Isthmus of Darien is a subject of such vast and far-reaching importance.

In the earlier centuries, after the discovery of America, almost every maritime power instituted careful explorations and surveys to ascertain the most practicable route for a canal; and in this century the policy of the greater powers has caused them to provide in their treaties with the Central American States, and with each other, and with the United States, for the regulation of their commercial and other interests in the canal, in peace and war, because its completion has been regarded as nearly approaching.

We are affected with admiration for the wisdom and forecast of British policies, but sometimes we have found the enterprise of that great power in disagreeable conflict with our rights and the security of our commerce.

There has been no occasion in which the friction of British interference has been more keenly felt than it was when the Crown interposed what that government insists is a barrier to the shortening of our coast line of travel and traffic to connect our Pacific States with our Gulf and Atlantic States.

Our attitude on that subject, and in reference to many others, is one of natural, peaceful, inevitable, and beneficent growth and expansion, in which all the world will find a rich harvest of blessings. The attitude of Great Britain towards us is selfish, obstructive, aggressive, grasping, and domineering. On a question that is attended with such incidents, if it were even unimportant as a practical question, I could not hesitate to align myself with my own country.

But I am not now intending to state the historic facts that make this a question of the highest importance and demonstrate that we have the right side of it. I only mean to say that the canal is the most important subject now connected with the commercial growth and progress of the United States, and I point to the British policy in relation to it as a powerful proof of its importance.

The canal through Nicaragua will now be built, and no company and no nation will be permitted to use it in such manner as to injure or seriously threaten or embarrass our coastwise commerce with our Pacific States. That is the new and practical phase of the question. Whether this is Monroe doctrine or the law of necessity, it is the resolve of the people of the United States. The only question that this resolve now presents to Congress is, whether we shall delay its assertion while it may be peacefully accomplished until some future time when its cost will be incalculable in money, in the sacrifices of war, and in the loss of precious lives.

I state the question in this way, because the construction of the canal is now an assured fact, to be realized within six years; and it is no less an assured fact that, in the near future, the loss to us of the practical control of this canal, as owner or part owner of the capital stock, would be in strong resemblance to, but more grievous to our people than the loss of our now divided dominion on the northern lakes.

As to these lakes, let me suppose a case for the sake, merely, of illustration.

If their northern coasts were occupied by a warlike people differing from us in race and language, with competing interests and a disposition to be aggressive towards us, instead of a race of the same blood, with strong ties of kinship between us and strong identity of interests, such as the Canadians have, we can at once see that a divided jurisdiction on the lakes could only be peaceably maintained by the presence of strong military and naval forces.

Such conditions would make war inevitable. When all the maritime powers shall meet in this isthmian canal it will be found that the best if not the only guaranty of peace and justice in the common use of the canal will be the power of some great nation having a right to control it. Without some such guaranty the canal and the states through which it is located would only become a temptation to the cupidity of the great maritime powers.

We can decline this duty if we prefer to sacrifice our coast trade with the Pacific States, or greatly to embarrass it, and if we prefer to see some great commercial nation

interpose between us and South America, and the navy of some great European power in command of the Gulf of Mexico and the Caribbean Sea.

I do not apprehend that the United States will ever be forced to this attitude by the pressure of the policy I have indicated. I think that will be impossible; but the cost of reclaiming in the future what we will presently lose by indifference to this matter will cause bitter reproaches to be heaped upon us by generations to come. The time to act is now, and the circumstances are at present more favorable than they will be at any time in the future for our peaceful and perfect success.

As it is my purpose to urge upon the Senate the necessity for early action upon this measure, I will pay no further attention to collateral questions that may arise than to say that whenever they arise and in whatever form they may come, our patriotic duty will be to meet them without flinching, and settle them in a way to satisfy the just demands of the people of the United States, whoever else may be offended at such a course. We must meet all such questions sooner or later, and the present is the best time to meet them.

To properly understand this measure it must be kept in mind that it is solely the work of the Committee on Foreign Relations, and is not in any sense the result of any suggestion coming from the Maritime Canal Company, or any officer or agent of that company, or of any person having a pecuniary interest in the canal company, or any other company, relating to the work upon the canal.

The willingness of the canal company to accept the provisions of the bill reported by the Committee on Foreign Relations is justly attributable to their desire that the means for the construction of the canal shall be furnished in the United States, and that the directors of the company and its stockholders shall be American.

No bonds of the company have yet been issued. The money that has been employed with such encouraging success in the beginning of the work has been realized from sales or pledges of stock to persons interested in the company.

The time has arrived when the stock of the company and the sales of its mortgage bonds must be resorted to in order to raise the money to conduct and complete the work, and the question is presented for prompt solution, whether the company shall raise the money in foreign or domestic financial centres. As a private enterprise the canal company must suffer an immense loss on the ultimate actual value of its stock and bonds in order to raise this money. This sacrifice will greatly increase the rates of tolls upon vessels passing through the canal whether the stock and bonds of the company are sold to the people of the United States or to European purchasers.

An investment that will draw no profits from the earnings of the canal until it is completed, which will be about six years from the present time, can not be a favorite among investors, except at a very large discount on the face value of the bonds and stock. This loss will count heavily in the basis upon which dividends are to be declared, as so much money expended by the company, and the canal, which it will cost less than \$100,000,000 in actual expenditure of money to construct and complete, will have cost the company more than \$200,000,000.

Aside from all other considerations the tax which will be thus imposed on the commerce of the United States in the enhancement of freight charges should be saved to the people by the United States Government. This will be done if we will loan to this company the credit of the United States on the terms as to security for the loan provided for in the bill reported by the Committee on Foreign Relations. Unless this is done the canal will be constructed at more than double the cost to the company for which it can be completed with such assistance.

That it will be constructed at whatever cost is now beyond reasonable doubt, and the commercial world is already very eager and imperative in its demand for the completion of this canal at as early a day as the work can be done.

The expenditure by the French people of a sum exceeding \$200,000,000 in the effort to construct a canal across the Isthmus of Panama sufficiently proves the estimate which that wise and intrepid people put upon the commercial importance and value, as an

investment, of a successful effort to cross the Isthmus of Darien with a ship canal. They were not mistaken as to its value, but they fell into a fatal error as to its location in disregarding the earnest protests of our commissioners to the Paris Conference in 1879.

The theory of M. Lesseps, whose opinions then stood for unquestionable certainty in canal engineering, was that, with money enough, the engineers could construct a sea-level ship canal across the Isthmus at Panama, and that it would be the shortest line between the oceans.

Responding to that opinion, the French people rushed to the conclusion, forced upon them by a just estimate of the financial, commercial, and military value of the canal, that too much money could not be expended legitimately in such an enterprise; that it would be a paying investment, even at a cost of \$500,000,000.

It can not be said, truly, that the French people overestimated the value of this great work as a source of revenue. But, it can now be said, in the light of a sad history, that M. Lesseps did not heed the advice of our American commissioners as to the location of the canal, and that a lamentable failure has resulted.

M. Lesseps, in locating a canal at the sea level, to be fed by the waters of the two oceans, and having no adequate supply of water at greater elevations to feed it, was forced to depress the bottom of the canal prism to a level that made it the constant prey of the Chagres River and the enormous floods of water that rushed down from the highlands through that channel to inundate and destroy the canal.

Nothing could protect the canal against such disasters but a reversal of the laws of nature that regulate the rainfall in the Isthmus of Darien. It was at this point that the Panama Canal project met its death, an event that our engineers clearly foresaw and predicted with confidence and earnestness at the Paris conference.

A sea-level canal across the Isthmus is now a confessed impossibility, and if there are advantages in such a canal over one with secure and convenient locks, in the saving of time and expense in the transit of vessels, it is not an unreasonable claim that the value to the ships of a passage of 170 miles through fresh water will more than counterbalance any loss of time or expense in lockage and delay in cleaning the ships' bottoms, etc., in opportunities for repairs, and coaling and victualing the ships, and in the refreshment of their crews.

But the commercial world will not now return to the plan of a sea-level canal through the Isthmus of Darien. That is exploded. The Suez Canal is through a country that has no obstructing ridge of high lands. When engineering science was in its earliest infancy it was able to dig a canal through the sands of the Isthmus of Suez, and to lead the waters of the Nile into it, to supplement those of the Red Sea and the Mediterranean in filling its prism.

M. Lesseps only repeated the history of a very early date with vastly increased facilities for digging and dredging another Suez Canal and securing its banks with concrete stones, the materials for making which were abundant, cheap, and near at hand. There is no real resemblance or parallel between the Suez Canal and the projected Panama Canal. The physical conditions are in the strongest contrast.

The tropical rains in Central America are the most difficult embarrassments to the maintenance of a great canal. It must be located out of reach of the sudden and excessive inundation that occur in that climate to make the work permanent or useful, and this can not be accomplished at any point in the Isthmus of Darien where the bottom of the canal through its entire length, or nearly so, is placed below the level of the sea.

The cost of such a canal at any point on that Isthmus would forbid its construction; but the other difficulty I have mentioned makes it impossible. Those who wish to dig a canal, and not merely to theorize about so grand an achievement, will consult the history of recent disastrous experiments in Panama and the inexorable logic of facts, and will turn their attention to some practical plan.

A canal with locks or lifts must have at its highest level an abundant and safe supply of water, and it must come from a fountain of supply that is not beyond control in periods of heavy rainfall and high waters. We have under our own observation here in Wash-

ington an illustration of the necessity of having a positive safeguard against flood waters in the fountains that feed a canal.

In a single flood the Cumberland Canal was made a wreck by the overflowing waters of the Potomac, along which it is located, and of the smaller streams that fed it, and it is now a task of great magnitude to restore it. In a country where a drainage watercourse will rise a foot, as an ordinary occurrence, while the Potomac would rise an inch under the heaviest rainfall in the mountains, we can understand how reckless a thing it is to place a ship canal along the course and frequently across the channel of a great river. The Panama Canal crosses the Chagres River seventy-eight times and the Rio Grande thirteen times. The entire length of the canal is 74 kilometers, while the canals to carry off these waters are 64 kilometers, only one-tenth less than the main canal.

The second great and essential condition to the construction and maintenance of a canal with locks or lifts, being an abundant, safe, and controllable water supply at the highest level, we search in vain through Central America, and would search in vain through the world, for advantages that approximate those afforded by Lake Managua and Lake Nicaragua. I mention them jointly for these reasons: They are both bound around their entire circumference by walls of rock, except at one place of outlet for each lake, and those are very narrow.

Lake Managua is north of Lake Nicaragua, and is at the foot of the highest ground in Nicaragua. It catches the waters from the mountains in the rainy seasons and confines them within its deep basin, from which they are drawn off to Lake Nicaragua through a narrow, rock-bound outlet. Lake Nicaragua has a superficial area of 2,600 square miles. The watershed is about 8,000 square miles, so that the heaviest fall of water never causes either lake to overflow its borders, and the highest flood only raises the level of Lake Nicaragua about two feet. At ordinary tide it furnishes ten times the water needed for the canal.

The relation of this system of lakes to the two oceans can be best described by the fact that they supply the water, in quantities that are inexhaustible, to feed the canal that leads out to each ocean; and the location of the canal is such that the level of Lake Nicaragua is maintained in it, with a few changes of flowage to a point within 10 miles of the Caribbean Sea on the east, and to a point within 4 miles of the Pacific Ocean on the west.

A signal from a ship at either extremity of this long level can be read on the oceans it almost connects.

The most fervid imagination is surprised and captured by this splendid reality.

I must not loiter among these grand and enticing developments. They will be blessings for posterity that will be richer in their results than it has yet entered into the heart of man to conceive.

It is but recently that the extension of this summit level of the canal for so great a distance has been thought of. The fact alone would defy the competition of every other fact in controlling the location of a ship canal in the Isthmus of Darien, and would force its location to the ground now selected. But much more important advantages are gained by this location. Along the left bank of the San Juan River, which is the outlet of Lake Nicaragua, from a point called Ochoa, to the southeastward, a range of low hills extends to the Delta of the San Juan.

At Ochoa (as may be seen from a photolithograph that accompanies the report of the Committee on Foreign Relations) two opposing points of highland furnish abutments for a dam across the San Juan River. This dam raises the surface of the river to the level of the lake back to its point of exit from the lake, and almost entirely dispenses with dredging through the whole extent of the river, a distance of 64 miles.

The other effect of the dam is to divert the water from the San Juan River to the northward and eastward behind the range of hills I have described as skirting the left bank of the river. There, in a reach of 18 miles, in the direction of and on the shortest route to Greytown, canalization is almost entirely dispensed with. A barrier of rock crosses this

estuary of deep waters thus formed at right angles. It is more than two miles in width, and near its eastern base is found the level of the seashore.

This rock, as building material for the dam at Ochoa and for the breakwater at Greytown, and for the locks, weirs, and other security for the canal and the railroad that is a tender to it, is a most valuable and essential feature of the work. De Lesseps had to manufacture stone for the Suez Canal. In the Nicaragua Canal it is obtained without waste of labor in the very prism of the canal.

Two miles inside the coast line at Greytown and 4 miles inside the coast line at Brito natural basins are found, in which five hundred sail can ride at anchor, with ample room. At all places along the line of the canal the largest ships can pass each other. The facts stated in the report of the committee and the appendices thereto, are from the most authentic sources. I will call attention to some of them that are most important further on in my remarks.

The view of this great subject that I have already presented, though it is a mere sketch of prominent facts, leads me to the conclusion that this is the only practicable project for a ship canal that has been or can be presented with any hope of a successful result. As to the cost of the canal and the income that it will yield I will speak presently.

I assume that this work deserves the political and financial aid of the United States, and that when it is built with money borrowed on private account, in the markets of the world, it will create a tax upon our commerce that it is the duty of the Government of the United States to prohibit, and that now is the time to accomplish that purpose.

Two questions arise in the minds of our people, or rather of our representatives in Congress, that deserve wise and thoughtful consideration in this connection. The first question relates to the power of Congress to pledge the credit of the United States in aid of such a work as this. The second question relates to our obligations to other powers which might stand in the way of this work of beneficence for our own people. I will first consider the second of these questions.

As to Nicaragua and Costa Rica, we find no impediment to our lending the credit of the United States to aid a work those states are so eager to accomplish. Our treaties with Nicaragua will only be the more perfectly observed and executed if we adopt a plan for aiding this canal company similar to that set forth in this bill.

As to the other American states, their privileges under the concessions of Nicaragua and Costa Rica for this canal are all preserved in this measure, and will be carefully protected.

As to European powers, none of them have ever thought it necessary to shape the policy of the United States in our relations to the Isthmus of Darien and the Central American States except Great Britain. The platitudes of the Clayton-Bulwer treaty, in which each party yielded something to the other that neither possessed, making mutual concessions for a consideration that did not exist and could not be valuable, have become a stale demand upon the people of both nations, and there is no longer room for their serious and practical treatment.

If one President and Senate can fix a theoretical or dogmatic policy upon our people for all time to come, because another policy may not suit Great Britain, it seems to be in vain that we ever attempted to divorce ourselves from the power of the British Crown.

To put it plainly and tersely, I only voice the sentiment of every generation of Americans when I say that it has always been and will always be impossible to bind them to an agreement that they will not help any local government to construct a canal through the Isthmus of Darien.

There is ground for impatience with the spirit that must first consult Great Britain before we can know what we may do for our own people. There has been too much of that fashion of snobbishness in American politics. All our ports are open to every British subject, as freely as they are to our own people. Yet a ship approaching a British-Canadian port loaded with supplies for their half-fed people would be captured, with guns if need be, and confiscated. British goods come and go across our soil to Canada, in bond and free of duty, but if we send a barrel of fish through Canada it is immediately confiscated.

Our right to ship goods without discriminative duties or charges through the Welland Canal is nullified by drawbacks in favor of goods that find the seaboard through the St. Lawrence River. We saved Oregon and Washington from British dominion only by the intrepidity of our pioneer population, but yielded to an unjust British demand the whole country between 49 degrees and 54 degrees 40 minutes north latitude.

Great Britain had neither a natural nor an historical right to that country. It was ours, and was won from us by the spirit of unceasing aggression. After we had acquired the Pribylov group of islands in our purchase of Alaska from Russia, Great Britain encouraged her Canadian subjects to slaughter the fur seals, until extermination is seriously threatened, and so to deprive us of a commerce that we alone can protect.

Open markets for fish, without duty, along our northeastern coast would, almost certainly, save our rights of property in fur seals. They deprive us of our rights, and then sell them to us. No clearer right came to us from the war of the Revolution than the right of free fishing on the coasts of Newfoundland, Labrador and Canada; but we were compelled to yield those rights, won from the French by the blood of our own people, to the arrogant demands and pressure of British aggression.

The Monroe doctrine was eaten away by the corrosion of British policy in the Belize, and aggressions, excused by a pretentious love for the rights of the vilest nest of freebooters that ever assembled on this continent, grew into crown colonies and are there now as defiant proofs of her disregard of the spirit of her treaties with the United States. If, in our desire to assist the commerce of the United States and to discharge the trust in favor of posterity that grows out of the control of the shores of the Atlantic and Pacific Oceans by connecting them through a short line of navigation, we shall offend against a lurking policy of Great Britain, shrewdly hidden away in an old treaty formulation of dogmas and economic doctrines, I shall be glad how soon the dust is removed from the hiding place of this ancient fraud.

If we need to have an influence in the direction of this canal, we will have it, so far as Great Britain is concerned. If we make it useful to our own people, we will make it equally useful to the world, except that no transatlantic power will be permitted to monopolize its ownership or control as against our own people.

The other question I have stated is whether Congress has power to loan the credit of the United States to this Maritime Canal Company. I know of no reason, and would deeply regret to find any, why the United States, in its sovereign powers, is not the equal of any other government.

In its internal and external relations it is the most powerful nation in the world, because it has the intelligent and affectionate support of a people who, in the aggregate and in the individuals composing it and controlling its destiny, are at least the equals of any other great community; and it is also founded upon the sovereignty of forty-four powerful States. The Federal representative of such powers must be powerful. We have had a chosen national policy that has confined our national endeavors to the western hemisphere, and will find useful employment in that grand field of development and progress for a long period to come. But in the necessary growth of our power our borders have enlarged, and we can safely claim that we have been an advantage of incalculable value to the people over whom our jurisdiction has been extended, and also to neighboring governments; even to those that yielded territory to increase our national domain.

Our influence has extended south to Patagonia, and has secured to all the vast area between the oceans the blessings of free, constitutional liberty and self-government.

The living example of this great Republic of Republics has wrought out the securities for personal liberty that are building up great communities into strong and free nations that were but recently weak and prone to decay. This example without the support of enough of power to maintain its teachings, would have been wasted on the people to the south of us, and would have left them still fettered with the shackles of foreign government.

In our growth we have found power enough to purchase the French territory, reaching from the Gulf of Mexico to the State of Washington, the Spanish territory of Florida, and the Russian territory of Alaska. We have found power enough in our national sovereignty

to annex the independent republic of Texas; and enough of military power to conquer and annex the vast domain, from Mexico, covered by the treaty of Guadalupe Hidalgo, and to purchase the great addition thereto covered by the Gadsden treaty.

In the way of providing facilities for the expansion and protection of our commerce in distant regions we have not done much, but we are beginning to feel the pressure of that necessity.

In Samoa we acquired the right to establish a naval station, and the slightest threat against its full and permanent enjoyment caused Congress to vote money to hold that station, and the President pressed negotiations upon other powers with urgency for its protection. In Hawaii we acquired similar but stronger rights in Pearl Harbor, and the Committee on Foreign Relations through the Senator from Oregon [Mr. DOLPH] have reported a bill to establish a naval station in that harbor.

But the Navy is not the only agency that we may properly employ in fostering and protecting our commerce in foreign countries. The power to use the Navy for any other purpose than warlike offense and defense, which is very clear, necessarily implies the power to use any other peaceful agency in extending and protecting our trade in foreign countries.

The use of a ship canal to shorten by two-thirds the distance between our Atlantic and Pacific coasts is a matter that stands most prominent in the necessities of our situation, and is as naturally included in our national powers and duties as the erection of lighthouses, the researches of the Coast Survey, the soundings of deep waters in foreign seas by the Hydrographic Surveys, the propagation of food fishes in the ocean, the Life-Saving and Signal Service, and the laying and protecting electric cables to distant countries.

Ships on the great oceans are not post offices, and post roads are not their invisible tracks, as they sail back and forth with our mails; and yet, we find no difficulty in establishing and supporting, with heavy appropriations, our trans-oceanic mail lines. We could build ships for these purposes as well as we can purchase their services for one or more voyages. It would be a curious state of case that we could build a ship to sail through the Nicaragua Canal with our mails, but we could not assist a company to open or maintain the canal.

It is not a new thought with me that I am a Democrat. My convictions as to the value of that creed have, at times, cost me everything except my life. I believe that the doctrines of that party are so essential to liberty, in the best meaning of that sacred word, that I would sacrifice all the external glory of the republic rather than deprive our people of the enjoyment of that blessing.

But American liberty does not require its votaries to live in a republic that is crippled in its powers or humiliated in its spirit. The best government in the world ought to be the strongest and the proudest. Its true glory and strength consist in the fact that its citizens are better protected against the aggressions of power than those of any other government. The Government of the United States secures to its citizens the supreme blessing of liberty because it has enough of power to protect them against all danger from foreign aggression, and it has not enough of lawful power to wrong the weakest citizen of the republic.

There are no restraints upon the power of the United States, as a government, except such as are interposed, under a written constitution, for the security of the individual man and the rights of the States. If no citizen and no State can justly complain of an act done by the United States respecting our foreign relations, that act must be within the just powers of the government.

Taxation of the people, except for government purposes, is not within the grant of powers to the Federal Government,

The purposes of government that are within the powers of the States are left by our constitution to their care, and the powers necessary to accomplish these purposes are reserved to the States and the people. Those purposes of government that from their nature are national, are put under the care of our Federal Government, with full and adequate powers for their accomplishment. These include all that is necessary to be done for the welfare of the people in our dealings and relations with other nations.

The power of Congress to borrow money on the credit of the United States is added to the powers of taxation, and was granted to meet all emergencies of government that could not be conveniently met through the power to raise money by taxation. We are constantly resorting to this power in order to execute those purposes of government that are intrusted to Congress and the President.

The extinguishment of the Indian title to tribal lands and funding the debt in our own bonds is a constantly recurring illustration of the employment of this power.

The sale of bonds to raise money to prosecute the late civil war is an instance of the use of this power in a way that is still compelling the heavy taxation of the people. The subsidizing of the transcontinental railroads is another instance of the use of this power in a much more questionable form than is presented in the provisions of the bill under discussion. The power of Congress to indorse the bonds of those companies has been conceded by all concerned as being unquestionable. The Supreme Court and many other courts, State and Federal, have predicated decisions upon those powers of Congress exercised even within the States of the Union.

The alleged purpose of the government involved in these subventions were the necessities of the then military condition of the United States in time of war; the holding in check of the wild Indian tribes of the West; the transportation of mails, troops, and munitions of war, and the regulation of commerce with the Indian tribes and foreign countries. It was only when they came in conflict with State authority that any question of the power of the United States was raised, and that was decided in the recent California tax cases in favor of the Federal Government, on the ground that the Central Pacific Railroad was an instrumentality of government.

Whatever question can be raised as to the policy of these subventions I think that none can now be successfully made as to the power of Congress to grant them. An estimate of the advantages that have inured to the people and the government from these transcontinental lines of railway is simply impossible. No man in the Senate would vote to destroy these roads under any circumstances. We would double the public debt rather than abolish them. We could not remand the country to the condition from which they have built it up, and no man can say that he would regret that the United States had indorsed their bonds even if it should result in the loss of the \$113,000,000 these roads now owe the United States, when he considers the blessings that the use of this great sum has bestowed upon the people.

Who is there that would destroy the locks in the St. Mary's River and leave the commerce of the lakes at the mercy of the rocks and floods? Who would destroy the Eads jetties at the mouth of the Mississippi, or the Mussel Shoals Canal on the Tennessee River, for five times the money they have cost? These and many others, indeed all other works on rivers and harbors, are based on the power of Congress to regulate commerce, coupled with the duty of Congress to make navigation free and convenient for commerce, because the States have ceded their navigable waters to the United States for those purposes.

The power to regulate commerce does not stop at our borders. It is beyond our borders that it finds its untrammelled action. From the beginning it has been one of the supreme cares of government to conclude commercial treaties with all the nations of the world. Could we not find the power in our constitution to devote the revenues derived from foreign commerce to facilitating the passage of our ships through straits and narrows in foreign countries by treaty agreement with them, as readily as we could pay them for reciprocity in trade by yielding to them the revenues on commodities exported by them to our country?

But I will not further discuss this matter, but will content myself with repeating my settled conviction that the proposed subvention to this canal company is as clearly within the power of Congress as it is to grant the charter that we are now proposing to amend. If I remember correctly, very few, if any, of the members of this body have denied that Congress has the power to enact the law under which this corporation was created. The votes recorded in the Journals of the Senate have certainly put that question at rest.

The care that the Maritime Canal Company has exercised in obtaining exhaustive sur-

veys of this canal route and the country adjacent to it, and the precision of its location, and the analysis of every engineering problem connected with it, and of every fact relating to its cost and income, has practically removed every doubtful feature from the subject.

The abilities of Mr. Menocal as a civil engineer are conceded by all who are informed as to his work in this and other fields. He has made the canalization of the Isthmus of Darien a study for many years, and has devoted his attention to the Nicaraguan route with earnest labor and zeal. He has examined that country in ten different years and has spent four years and six months there in continuous work as an engineer. It is no exaggeration to say that he is the thorough master of the subject. His associates in these labors are also men of distinguished abilities. The appendices to the report of the committee on this measure set forth his estimates in such accuracy of statement and measurement and in such full and exact detail that any mistake or error of any importance cannot escape detection.

On pages 101 to 106 of the report of the committee will be found the full statement of the cost of the canal and all its belongings, as estimated by Mr. Menocal, the grand total being \$65,064,176. This estimate includes a railroad and telegraph line, and all the necessary work on the harbors of Brito and Greytown, at the terminal points of the canal.

* * * * *

The estimates submitted by Mr. Menocal in January, 1889, were then submitted by the company to the careful revision of Messrs. John Bogart, E. T. D. Myers, A. M. Wellington, H. A. Hitchcock, and Charles T. Harvey, each of whom is a distinguished and experienced civil engineer.*

* * * * *

Here we have Menocal's report of the cost of the canal, the railway and telegraph line, and the maximum cost of the entire work computed on the same data by these other five civil engineers. That computation allows 20 per cent. to cover all contingencies of construction and every other probable disturbance of the work, and makes the cost of the work, all told, \$87,799,570. That allowance for contingencies was in addition to \$13,016,176 allowed in Mr. Menocal's estimates for the same reason. I could not possibly present in a safer form the merits of Mr. Menocal's report than is done in this review, which I will read:

* * * * *

The estimate of the committee, that the entire cost of the canal, including interest on the bonds, can not exceed \$100,000,000 when it is fully completed, is certainly a safe one.

That this will be a line of transit that will, at a moderate tax upon commerce, yield a revenue equal to that of the Suez Canal no one will entertain a doubt. That it will ultimately yield a much greater revenue is easily capable of demonstration:

* * * * *

The French estimate of the income of the Panama Canal is stated by Lieut. Charles C. Rogers, United States Navy, as follows:

PROBABLE TRAFFIC OF THE CANAL.

In 1870 the traffic of the Suez Canal was represented by 486 ships of 485,911 tons, yielding a revenue of 5,159,327.22 francs; in 1885 it had increased to 3,624 vessels, of 8,985,411 tons, and paying the company 62,207,439.21 francs. Not being familiar with the detailed statistics of the world's commerce, and such information not being at hand, it is useless for me to attempt a discussion of the financial future of this great enterprise.

But it may be of interest to the department to know the estimates upon which the canal company and its subscribers base their hopes of success. M. Levasseur, member of the Institute, takes the statistics of 1876 as a basis of calculation, and has estimated that if the canal were open in 1889 the total tonnage of vessels passing through it would be

*See Appendix No. 8.

7,250,000. But the following table, published in the Bulletin du Canal Inter-oceanique, shows in detail the estimates of M. Amédée Marteau, chief editor of the capital Journal du Havre:

Movement of ocean trade of England with Pacific in 1884.

COUNTRIES.	SAILING SHIPS.				STEAMERS.				TOTAL.	
	Entries.		Departures.		Entries.		Departures.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Pacific Islands.....	11	5,659	4	3,164	1	1,198	2	1,656	18	11,873
United States, Pacific coast	288	370,058	140	211,597	2	3,518	8	4,761	428	589,929
Peru.....	102	70,025	97	74,457	11	19,424	18	19,484	228	188,891
Chili.....	108	64,212	256	184,811	31	64,688	40	71,652	435	385,263
Colombia.....	12	3,262	55	32,484	47	84,695	74	106,589	188	226,980
Bolivia.....	20	18,041	21	15,496	1	881	42	29,418
Total.....									1,184	1,426,852

Movement of ocean trade of France with Pacific in 1884.

COUNTRIES.	Entries.		Departures.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.
Peru.....	189	120,153	15	19,939	154	140,092
Chili.....	48	75,327	81	106,053	129	181,380
Colombia.....	70	117,724	59	90,006	129	207,730
United States Pacific coast.....	29	42,108	4	2,624	33	44,732
Total.....	286	355,312	159	218,622	445	573,934

Movement of ocean trade of Hamburg with Pacific in 1884.

COUNTRIES.	Entries.		Departures.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.
California, Pacific coast.....	1	862	2	1,841	3	2,703
Mexico, Pacific coast.....	11	4,099	13	5,156	24	9,255
Central America, Pacific coast. . .	8	4,156	9	2,740	17	6,896
Chili, Pacific coast.....	62	55,902	73	62,134	135	122,036
Peru, Ecuador and Bolivia, Pacific coast.....	156	129,121	25	18,416	181	147,537
Total.....	238	198,140	122	85,237	360	283,427

Movement of ocean trade of England with Australia and Pacific islands in 1884.

COUNTRIES.	SAILING SHIPS.				STEAMERS.				TOTAL.	
	Entries.		Departures.		Entries.		Departures.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Australia.....	243	253,898	368	436,847	96	207,678	174	311,887	881	1,216,901
New Zealand.....	109	101,556	90	87,350	27	66,865	33	70,609	259	226,880
Java.....	116	108,780	96	81,061	17	26,223	78	124,054	307	335,098
Philippines.....	27	18,169	7	7,105	20	52,947	18	32,668	72	110,889
Total.....	495	477,494	561	612,348	160	353,713	303	538,818	1519	1,988,278

Maritime movement of France in 1884 with the countries below.

COUNTRIES.	Entries.	Departures.	Total.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Australia.....	86,757	7,448	94,205
Oceanica.....	112,128	1,128
East Indies.....	81,744	48,920	125,664
New Caledonia.....	40,252	52,227	292,479
Total.....	209,881	108,595	318,476

Holland Countries of production or of destination.

COUNTRIES.	Entries.		Departures.	
	<i>No.</i>	<i>Tons.</i>	<i>No.</i>	<i>Tons.</i>
Chili.....	27	23,824	69	57,444
Peru.....	50	33,696	18	13,373
Guatemala (Pacific).....	6	2,653	8	3,567
Colombia (Pacific).....	51	83,088	55	83,827
Colombia (Atlantic).....	268	267,926	77	242,279
Australia.....	218	261,302	92	174,420
Philippines.....	106	110,881	11	11,581
Dutch Indies.....	22	11,886	76	60,502
China.....	41	51,569	20	27,411
Hong-Kong.....	107	188,436	70	156,677
Japan.....	81	38,057	87	51,254
Mexico (Pacific coast).....	91	27,099	83	33,214
East Indies.....	121	150,775	78	98,301
Total.....	1,184	1,260,593	994	1,006,849
			1,184	1,260,593
Grand total.....			2,128	2,269,441

SUMMARY.

Estimates of tonnage passing through the Panama Canal in 1884.

	<i>Tons.</i>
Movement of ocean trade of England with Pacific.....	1,426,353
Movement of ocean trade of France with Pacific.....	578,994
Movement of ocean trade of Hamburg with Pacific.....	233,427
Movement of the other ports of Germany with Pacific.....	76,573
Movement of other European ports with Pacific.....	210,000
Movement of ocean trade of England with Australia and Pacific islands.....	1,933,279
Maritime movement of France with Australia, Oceanica, East Indies, and New Caledonia.....	313,476
Maritime movement of Hamburg with same countries.....	70,000
Maritime movement of other ports of Germany with same countries.....	80,000
Maritime movement of other countries of Europe with same countries (Holland, Spain, Italy, Greece, etc).....	300,000
Total of countries of production or of destination....	2,269,441
*Grand total.....	7,536,982

* For estimate of revenues of the canal, prepared by the company, see Chapter VI.

I think the majority opinion in the committee was that the canal traffic, exclusive of passenger traffic, would not fall below 7,000,000 tons per annum.

MR. HOAR. How much?

MR. MORGAN. That it would not fall below 7,000,000 tons per annum, and that, even at \$1 a ton, to say nothing of the \$2.50 that is charged by the Suez Canal, would more than pay the interest on the debt, and the expense of keeping the canal in order.

With these facts before the committee, they could not hesitate to declare their unanimous conviction on three essential points, namely:

First. That this canal ought not to be permitted to cost a sum exceeding \$100,000,000 as a basis on which to levy taxation on the commerce that will pass through it.

Second. That such a sum of money could not be raised on private loans in the United States or in transatlantic countries, except at too great a sacrifice in interest and discounts, and by the absorption of the stock of the canal company.

Third. That it is the duty of the government of the United States to so provide that the direction of the affairs of the company, in accordance with the concessions from the Governments of Nicaragua and Costa Rica, should not pass into the control of any but Americans.

Great ship canals, like those of Nicaragua and Suez, have a relation to the commercial and naval affairs of all nations that makes them, of necessity, political factors of the most important character.

Aside from all ambitious considerations, their guardianship will be ultimately devolved upon powers that are strong enough to secure to all nations a just participation in their benefits. With less governmental security than that they would soon attract the efforts of enterprising powers to seize and appropriate them, and that would create strife that would afflict the world.

The United States could not abdicate such an influence in the Nicaraguan Canal without injustice to the Western Hemisphere and without national dishonor.

The history of our dealings with other nations, as well as the nature and spirit of our non-aggressive government, is a full guaranty to all the nations that our influence in the control of the affairs of the canal will be impartial, just and friendly towards each and all of them.

We have no national need to fill up our Treasury with tolls exacted from the commerce of other countries or of our own people. We seek only to enrich our government by giving to our people proper opportunities to enrich themselves by honest industry.

In line with this established policy the chief interest that our government has in this great work is to place its benefits within easy reach of our people.

To do this it is the duty of the United States to assist in this work, in order to give to it credit, permanency, economy of administration, cheapness of tolls, and freedom of use for commercial purposes.

The bill and the report of the committee disclose fully, and without reserve, the entire line of action that the government of the United States should, in the opinion of the committee, adopt in reference to this great work.

The facts stated in the report of the committee, and more in detail in the appendices thereto, show that the Maritime Canal Company have made very remarkable progress in this work.

Their expenditures have been characterized by careful and wise economy, and have been drawn from their own private contributions of money and credit. No bonds have been sold and only a small amount of stock; excellent buildings for the use of the company, including comfortable quarters for the laborers, hospitals, storehouses, wharves, and machine shops have been amply provided.

The clearing for the line of the canal and railroad has been made from the seacoast to the hills of the interior, a distance of 12 miles, and the dredges, purchased from the Panama Canal Company, are at work on the canal and the approaches to it. The railroad is built in excellent style out to the foot of the hills, passing through a swampy region that was considered very difficult. The pier or breakwater extending across the bar at the harbor

of Greytown, has already demonstrated that the water there can be deepened by natural erosion, so as to accommodate the largest ships. Not one apprehended difficulty has been encountered that has not been more easily overcome than was expected.

The committee found that the company felt entirely confident of their ability to progress with the work through the assistance of money to be raised by the sale of mortgage bonds and the pledge of the stock of the company. But they expected that the discounts upon their securities in the markets, and interest, and brokerage, and other commissions would be so great that it would require the issue of a large sum in excess of \$100,000,000 of bonds and the addition of \$75,000,000 of the stock of the company to enable them to secure the money to finish the canal in five or six years.

The committee thus state that the burden that would fall upon commerce by reason of the inability of the company to obtain money to construct the canal at reasonable rates in the markets, on pages 14 and 15 of the report, which I will venture to read, as a better statement and explanation of that point than I could possibly give at my desk in the Senate:

"The act incorporating the Maritime Canal Company of Nicaragua provides that the capital stock of said company shall consist of not less than 1,000,000 shares of \$100 each, or \$100,000,000 with the right to increase the capital stock to 2,000,000 shares of \$100 each, or \$200,000,000 on the vote of two-thirds of the stock of said company at any time outstanding. It also authorizes the company in the construction of said canal, and to carry out the purposes of the act, to issue its bonds and secure the same by mortgage on its property and rights of property of all kinds and descriptions, real, personal, and mixed, including its franchise to be a corporation. The amount of said bonds is not limited, but assuming, as the act contemplates, that it would be equal to the amount of stock outstanding, the amount of stock and bonds might range from \$200,000,000 to \$400,000,000, with authority to increase the amount of bonds to an indefinite extent.

Under the provisions of this charter the Maritime Canal Company entered into a provisional contract by which the canal company agreed to pay the construction company, for the work proposed, stock to the amount of \$92,500,000, being the total stock authorized, less concessions to Nicaragua and Costa Rica, and \$150,000,000 in bonds, an aggregate of \$242,500,000. It was assumed that the bonds of the company, bearing interest at 5 or 6 per cent. per annum, could be sold at the rate of about 60 cents on the dollar, the rate at which the first bonds of the Suez Canal were sold.

The stock was to be given to the contractors as a bonus to induce them to undertake the contract. In view of the difficulties in the way of the enterprise, your committee is of the opinion that the contract was as favorable a one as could be made, if we may judge by the contracts made for similar undertakings by private companies and in view of the risks and hazards of the future. The ability of the construction company to perform the work, even for this great sum, would depend entirely upon its ability from time to time to sell the securities of the Maritime Company.

Any stringency or fluctuation in the money market might prevent their sale and thus arrest the progress of the work. Any neglect on the part of the Governments of Nicaragua and Costa Rica to protect the contractors in the performance of the work would necessarily add to its cost, and perhaps as in similar enterprises disable the company and forfeit their charter privileges. Any failure of the bankers purchasing these securities to pay for them according to the conditions of the sale would have the like effect. The work is so great and the benefit of its completion so transcendent that it would seem that its execution should not be left to private enterprise that, in the chances of the future, may fail.

It is doubtful whether any private company, corporation, or combination, however strong it may appear, would be able to complete so great an enterprise, one that could yield no income during its progress, and could not in any event yield profit until after the whole enterprise was completed. Unlike railroads, the investment could not yield any income or profit until it was demonstrated by actual trial that commercial vessels could pass from ocean to ocean with reasonable facility, and without delay or danger. In whatever view the committee could take of the enterprise there appears grave doubt whether it could be

executed without the strong, certain, and powerful support of a great nation or a combination of nations."

Hon. Warner Miller, whose ability as a financier and as a statesman has become historic in the Senate, thus states the causes which, in the beginning of a great enterprise like this, depress the market for the bonds of the best organizations. I beg leave to read, as I think it is important:

By Mr. PAYNE:

Q. That embraces his estimate for the extras?

That is, the engineer's estimate.

A. Yes. "Now, as to the method of raising this amount of money; of course, it can only be done by selling the securities of the company. They consist, or will consist, of stock and bonds. Since I have been president of the construction company I have consulted with many leading financial men in the country, and of course it is impossible to say at this time at what price bonds of the company could be negotiated, but I am frank to say that I do not believe that they can be negotiated at par or very near it. This is a peculiar enterprise, which presents many obstacles, and of course it will be looked upon by the investing world as somewhat problematical.

The first bonds of the Suez Canal, I believe, netted the company only about 60 cents on the dollar. How much more than that we shall be able to obtain for our bonds I am unable to say, but I have no doubt but what the bonds can be negotiated in the markets of the world at a price much above that of the first Suez bonds. The present intention of the company is to make arrangements with what would be called a syndicate of bankers, getting one large and reputable banking house to take the lead in the matter, and that house to associate with itself a large number of banking houses in this country and in London, and in Amsterdam, and in Frankfort, and in Berlin—houses which are now in the habit of associating themselves together for the placing of large loans or the placing of a large amount of securities—and expect to make a contract with the leading house, the head of the syndicate, to take these securities and market them as best they can, so as to give us somewhere in the neighborhood, we will say, of ten to fifteen millions of money per annum as the work shall go on.

Banking houses are ready to undertake this work, and the only question about it is a question of commissions and the question as to what price the bonds shall go to the public in order to induce them to take them. We can not expect the public will come in and take these bonds unless they are offered to them at such a price as to give them a large profit in case the work succeeds. This project is entirely different from the project of building a railroad and issuing bonds upon it as it is constructed."

In consideration of the concessions made by the Governments of Nicaragua and Costa Rica to the Maritime Canal Company, 6 per cent. of the stock of the company is to issue to Nicaragua and 1 1-2 per cent. to Costa Rica. This bill limits the capital stock of the company to \$100,000,000, leaving \$92,500,000 of stock to be disposed of after satisfying the obligations of the company to those states.

Of this sum \$70,000,000 are to be issued to and in the name of the Secretary of the Treasury of the United States as a pledge and security to the United States for the redemption of the bonds and interest issued to the company in payment for work done on the canal. At any time before the maturity of the bonds the United States shall have the option, in the discretion of Congress, to take the stock at par and dispose of it.

Section 7 of the bill extinguishes all existing liabilities of the Maritime Canal Company except those to Nicaragua and Costa Rica for stock, as I have already explained, and in full payment for the same and for all property acquired, material furnished, services rendered, and work performed it turns over to the company \$7,000,000. Of that sum, bonds issued and guaranteed by the United States are to be delivered to the company by the Secretary of the Treasury to the amount that he shall ascertain to have been actually paid out and expended by the company in the construction of the canal, with interest thereon at 6 per cent., and the residue of the sum of \$7,000,000 is to be paid to the company in non-assessable stock.

It will require a large part of this stock to meet the engagements of the company which are outstanding and are to be canceled so as to leave the company without any debt or liability of any kind, except the percentage of the stock that is to be issued to Nicaragua and Costa Rica.

This company is composed of men of excellent character and has acted in good faith and with marked courage and ability in the promotion of this great American enterprise, and it well deserves the confidence of the government and the approbation of the people.

Men who have been able to inaugurate successfully this immense work, with no resources but their own private fortunes, and in face of the competition, if not the opposition, of the Panama Canal, then promising to be a great success, confer honor upon their country and deserve fair and considerate treatment, which I have no doubt will be cordially given them.

They are all well known for their high character and patriotic zeal for the honor of their country. They are entitled to much credit for the readiness they have exhibited to yield the financial advantages which they had secured in order that their government might have an unobstructed course in securing to the people the great blessings of free transit for ships through the Isthmus of Darien—a blessing which no company and no nation should be permitted to monopolize.

The merits of this bill and all its surroundings and incidents will stand the closest scrutiny, and that is invited by the Committee on Foreign Relations. They have no doubt or apprehension that the stock of this company will be at par, or above par the day the canal is completed. They believe that it will be constructed and in complete working order within six years from the date of the passage of this bill. They are satisfied that the whole expenditure in the construction of the canal will not exceed \$70,000,000, and that it will speedily acquire a business amounting to 7,000,000 tons of actual freight, and 4,000 passengers per annum, and that, at one-half the rate of charges exacted by the Suez Canal, it will pay all operating expenses, the interest on its cost, and a dividend of 8 or 9 per cent. on the money invested in it.

They conclude from the undisputed facts presented in their report that the Government of the United States will not lose any money by its indorsement of the bonds of the company, but will, if it chooses to do so, make large profits by converting the bonded indebtedness into the stock of the company. The government having assisted transcontinental railroads by the loan of its credit and by immense grants of lands, it is only just to the people that they should have the advantage of the fair competition between land and water routes of transportation for the interchange of trade between the Eastern States and those lying west of the Rocky Mountain range.

The \$118,000,000 that the United States will be entitled to have refunded from the Union and Central Pacific Railroad Companies about 1897 has been bread cast upon the waters in our splendid developments. It will all be paid in cash into the Treasury, but if it were all lost the country has been benefited \$1,000,000,000 by its use. If any emergency in the finances of the country should make it convenient to apply that fund as it is paid into the Treasury to the construction of the Nicaraguan Canal, it will be in easy reach of the power of the Government for that purpose.

What great sum of money, unless it was the \$15,000,000 paid to France for the Louisiana territory or the \$15,000,000 paid to Mexico for the Gadsden purchase, has ever accomplished so much for the country as this \$118,000,000 will do if it is employed in opening the canal through Nicaragua, after it has aided in building the pioneer lines of railway from the Mississippi River to the Pacific Ocean? In the few statements that I have made to-day I have scarcely touched upon the great body of facts of the most interesting and conclusive character embodied in the appendices of the report of the committee. I have only attempted to open the door to inquiry and invitation to others that they may enter upon this great subject and display its importance as it deserves.

The Southern States have such great and peculiar interests in this measure that I have feared to attempt to advocate it lest I might not present its merits worthily. I have hoped to live to witness the completion by the people of the United States, who are the Govern-

ment, of this inexpressible blessing to mankind, which will, when completed, be the most impressive memorial of the genius, enterprise and good-will of our people that they can ever place on the records of their history outside their own territorial limits.

That only 19 miles of actual canalization should be required to bring the waters of the Atlantic and Pacific into union, with the largest ships passing freely through from ocean to ocean, seems to threaten us with reproach if we fail, when we know that we can so easily and so safely remove the barrier, and in doing this secure great profits from the outlay. I shall be very proud if it shall turn out that I am one of the generation of men who will have the courage to obey this evident duty imposed upon us by the great powers and resources of wealth and strength committed to our keeping. If I could serve in the Senate for a century, and in every moment could be endued with the wisdom of Solomon, I could find no opportunity to bless the people of Alabama so greatly as this, which is thrust upon me with a command that I do not dare to disobey.

[During the delivery of Mr. MORGAN'S remarks the hour of 12 o'clock arrived, when, on the request of Mr. BLAIR and by unanimous consent, the regular order was postponed and Mr. MORGAN allowed to conclude his speech.]

APPENDIX VIII.

REPORT OF THE BOARD OF CONSULTING ENGINEERS ON THE PLANS AND ESTIMATES OF THE CHIEF ENGINEER.

To the Nicaragua Canal Construction Company:

GENTLEMEN—The undersigned were requested by your letter of January 10th, 1889, to examine the plans and estimates prepared by your Chief Engineer, Mr. A. G. Menocal, for a Ship Canal between the two oceans at Nicaragua, and to indicate the cost, in their judgment, of constructing a canal along the line proposed and following, in general, the plans of your Chief Engineer. You also requested an opinion upon the practicability of the canal as now proposed, with due reference to the end in view, namely, the safe and convenient passage of sea-going ships from ocean to ocean. We beg to present the following report:

We have carefully examined the unusually full maps, profiles, borings, samples of materials, etc., etc., which have been prepared and collected under the directions of your Chief Engineer, and the completeness and excellent form of which reflect credit upon your engineering staff.

We find certain elements of the designs submitted which may probably be advantageously modified; this would, in some cases, reduce, and in others increase, the quantities. It is also altogether likely that some parts of the work may be let at lower, and other parts at higher prices than are estimated. We, however, are disposed to base our conclusions on quantities and prices which should prove sufficient to accomplish it upon the assumption of good and honest management, backed by an ample treasury. We have necessarily borne in mind the fact that the cost of the notable precursors of this canal project, both at Suez and Panama, has greatly exceeded the amount of the original estimates, and that this has been true of many other important works. While this might be, perhaps in a large measure, traced to unfortunate management as well as the lack of such careful preliminary studies as have been laid before us in this case, we have nevertheless endeavored to guard against a similar result by a liberal allowance for every apparent contingency.

Acting on this principle, we have not deemed it wise to reduce the quantities or prices of your Chief Engineer's estimates in any instance, even when it appeared possible that this might prudently be done. His figures are, of course, founded upon a better knowledge of the local conditions than we can now possess. But to the extent to which it has appeared at all doubtful we have liberally increased one or both. Our conclusions are as follows:

The project, as a whole, appears to have comparatively few elements of doubt about it, as contrasted with other works of at all similar magnitude, and we consider it to be unquestionably feasible. The great area of Lake Nicaragua offers immunity from serious floods by regulating flow. Much of the earth excavation and dredging, the rock drilling and the concrete mixing can be done by mechanical means, to that extent reducing the need for manual labor. The dams and embankments are proposed to be made largely from the immense mass of otherwise useless rock spoil. Under the climatic conditions, as we understand them, an adequate supply of labor should be obtainable. The project in detail consists of the following elements:

First. Of 10 miles on the east end and 0.57 miles on the west end of sea-level canal dredged in from the coast. The borings submitted seem to warrant the opinion that this will be entirely through alluvial deposits, as is also the case in certain parallel river diversions. The samples of material taken from these borings all appear favorable for dredging

and the cost of such dredging can be foreseen with the greater precision, because less influenced by climate, weather, and rates of wages than most other engineering work.

Second. Of a flight of three locks on each end, all within a distance of about one and one-half miles at one end and two miles at the other, by which the ascent is made from the sea-level to the summit-level of 110 feet, (this elevation being some four feet less on the eastern end to allow for a necessary fall of three-fourths of an inch per mile in the San Juan River). These locks are shown by the borings submitted to be all founded on rock. The proposed size for locks, 650 feet by 70 feet by 80 feet deep, seems sufficient for all demands.

Third. Of a very long summit level of 155.98 miles, consisting of four main parts:

a—The great divide cuts of three and eight miles in length respectively which are shown by the evidence submitted to consist chiefly of rock, overlaid with a few feet of earth.

b—The Deseado, San Francisco, Machado and Tola basins, formed by dams, furnish 21.57 miles of slack-water navigation, 18.13 miles of which require no excavation, and the remaining 3.44 miles earth dredging only.

c—The River San Juan, raised in level by a dam at Ochoa so as to furnish slack-water navigation, and Lake Nicaragua furnish, together, 121 miles of free navigation, of which 86.5 miles require some earth dredging and 3.83 miles some rock dredging.

d—An inconsiderable amount (1.63 miles) of canal section in earth, chiefly to connect the San Francisco and Machado basins.

The two great rock cuts are by far the heaviest features of the work. In considering the plans for them, and determining the proper amount and cost of work, we have felt that every provision should be made to secure permanent slopes and to provide a section suitable for any vessels which can pass the locks. We think that the estimates, as modified by us, will secure these results.

The four great basins present a most admirable feature of the plans. As compared with a restricted canal channel, they facilitate navigation as well as reduce the cost. They are made, as is also the slack-water navigation of the San Juan River, by dams and embankments of considerable extent, none, however, of very great height. The plans submitted provide for forming these dams and embankments chiefly of heavy rock filling, the proximity of the great rock cuts (from which material must otherwise be wasted) to the sites of these dams and embankments, facilitating their permanent construction at moderate cost. While we are not ready to say that the details of the plans submitted may not be, in some respects, modified, we regard the estimates adopted as sufficient to attain the results desired, subject to the following contingency:

There is the possible hazard in respect to the San Francisco and other basins, that they may not prove sufficiently retentive, owing either to leakage around the ends or under the bases of the dam and embankments, or to concealed permeable strata beneath the natural surface. We deem this a remote danger, since both the surface and subterranean formations, so far as revealed by borings and by the reports of the observations of reliable men, familiar with the locality, are favorable.

For a work of ordinary magnitude we would accept such evidence as ample, but, in view of the great area and volume of the basins, we agree that the possibility ought to be covered by the estimate. The probability is great that there are no permeable strata beneath the surface; if they exist they might not necessarily cause leakage, and even if leakage resulted it would not necessarily do serious harm. Concentrated leakage, if it occurred, might possibly be remedied, and, if it should develop at all, would be likely to occur at an early stage of the work of construction. The worst result to be feared is that it might impel a modification of the original features of the project, enforcing a lowering of the water level at certain points, and at an additional cost of about \$7,000,000. Under the circumstances, we, out of abundant caution, have deemed it wise and right to make the general contingency of allowance (\$14,683,262) large enough, in our opinion, to cover this amount.

The requisite depth in the San Juan River and in Lake Nicaragua is obtained by a considerable amount of dredging, largely of earth, but also with an amount of rock blasting under water, the precise extent and cost of which it is exceptionally difficult to foresee. We have therefore made an allowance for this work.

We have included in the estimates the sum of \$1,035,000, for the diversion of the Rio Grande, as it seems proper to provide for the possible necessity of the diversion of this important stream from the canal. We have also included in the estimate the amount named by the Chief Engineer for the work that may be necessary in the valley of the San Carlos and in the construction of the canal between Lake Managua and Lake Nicaragua, this construction being a requirement of the concession.

The estimates for the harbor improvements at Brito and Greytown we leave unchanged. It appears probable that the amounts estimated may prove ample for all requirements other than gradual enlargement of basin areas, but whether so or not (and it is always extremely difficult to anticipate with certainty what may be the ultimate requirements for work of this class), we do not see the necessity in this work, as we do in the canal proper, for the endeavor to provide at the outset for all future demands of commerce. Sufficient expenditure prior to the opening of the canal to meet reasonable requirements for the first year or two after opening, is all that we have taken into consideration in our estimates. The canal once opened, adequate harbors can certainly be provided at a moderate percentage on the total cost of the canal, even should the sum herein estimated for harbors and contingencies prove insufficient. We must not be understood as implying by this statement, however, that we now see reason to fear that the present estimate for harbor work will probably prove inadequate. Such is not the fact.

It may not be regarded as improper to mention also that while the cuts, locks, dams, etc., etc., should be completed for the full depths at the outset, something like one-fifth of the total amount of the estimate is for dredging and earth excavation under water, which is not required to afford 20 feet draught, and which can be completed with little or no disadvantage after the canal has been so far constructed as to pass vessels of that draught, making it possible—if found advisable—to open the canal for 20 feet draught for about four-fifths of the final cost.

Our estimate, which is intended to represent the maximum sum which the canal ought to cost, assuming, as aforesaid, integrity, good management, and no interruption of work from financial or other causes, is as follows:

Auxiliary railways, double track, standard gauge, from Divide Cut east to Greytown, and from Divide Cut west to Ochoa Dam, 20 miles and telegraph, temporary and permanent systems.....	\$1,110,000
Same on Pacific slope, Rio Lajas to Brito, 18 miles.....	459,000
	<hr/>
	\$1,569,000
Harbor Works, Greytown.....	\$3,550,667
Harbor Works, Brito.....	1,720,128
	<hr/>
	\$4,270,795
Carried forward.....	<hr/>
	\$5,839,795
EASTERN DIVISION:	
Brought up.....	\$5,839,795
Section 1. From Greytown to the Divide.....	5,296,527
" 2. The Eastern Divide.....	18,333,639
Locks Nos. 1, 2 and 3.....	4,195,826
Division of the Desado and San Juanillo.....	982,016
San Francisco Division.....	5,411,551
LAKE AND RIVER DIVISION:	
Rio San Juan.....	\$3,685,701
Lake Nicaragua.....	2,211,825
Dam at Ochoa.....	726,187

THE NICARAGUA CANAL.

WESTERN DIVISION:

From Lake Nicaragua to the Pacific.....	\$12,188,849
Diversion of Rio Lajas.....	846,786
La Flor Dam.....	577,580
Locks 4, 5 and 6 and Guard Gates.....	3,899,116
Right of Way Indemnity.....	100,000
Auxiliary Work—Guard Gates in Divide, Piers at Lake, Bridges, etc.....	1,189,018
Embankments and Weirs in the Valley of the San Carlos, and canal between Lake Managua and Nicaragua.....	1,000,000
Diversion of the Rio Grande.....	1,085,000
For Engineering Management, Labor Agencies, Shops, Police, Sanitary Ser- vice and Incidentals.....	6,250,000
	<hr/>
	\$73,166,808
Add to cover specified and unspecified Contingencies of Construction, 20 per cent.....	14,683,262
	<hr/>
Grand Total of Estimate.....	\$87,799,570

In conclusion, we think it proper to express our opinion that the exploration and studies of the region have been sufficient to warrant the conclusion that, unless hindered by obstacles or sinister influences such as would, if permitted to weigh, forbid the success of all ventures, this enterprise is full of promise.

Respectfully,

JOHN BOGART,
E. T. D. MYERS,
A. M. WELLINGTON,
H. A. HITCHCOCK.

I concur in the foregoing estimates as being in the aggregate ample for the purposes stated.

CHAS. T. HARVEY.

May 9th, 1889.



THE CATHEDRAL OF RIVAS, FIVE MILES FROM CANAL LINE.



MARKET IN GRANADA.

APPENDIX IX.

VOLCANOES AND EARTHQUAKES, NICARAGUA AND COSTA RICA.

SAN ANTONIO ARSENAL, SAN ANTONIO, TEXAS,
June 22nd, 1891.

To the President Nicaragua Canal Construction Company:

MY DEAR SIR:—I have your letter of 18th instant, in which you invite me to give a general description of the volcanic phenomena found in that portion of Central America traversed by the Nicaragua Canal, and to express any conclusions which I may have reached concerning the effects of possible earthquake disturbances upon the proposed structures of the Canal.

In reply, I would say that the portion of the Canal between Lake Nicaragua and the Caribbean, apart from the San Juan River, traverses a country in which the rocks of the surface are mainly volcanic, but belong to a past geological age. No recent volcanoes or lavas are known to exist anywhere in the vicinity. Volcanic action has been wholly extinct there during the present geological age, and the surface lavas have been decomposed into a red clay, containing occasionally rounded boulders of the original rock as the last remnants. Underneath these red clays other lavas are found, some of them in a good state of preservation, others showing a partial decomposition. Interstratified with them are beds of volcanic ashes, to which your surveyors have given the name of slate and telpetate.

The active volcanoes which are nearest to this portion of the Canal, are situated in Costa Rica. There are two chains of volcanoes in Costa Rica, which exhibit signs of unrest and which may be regarded in a certain sense active, though the activity of some of them is nothing more than a little steam at the summits or from lateral vents. Much the greater number of peaks in these two chains have given no sign during the present century, and in most cases have been silent ever since the discovery of the country. There are, however, four or five of them which must be regarded as active, for they have within a century broken out in strong eruption and still maintain a condition of unrest.

Of the two chains, the one nearest to the San Juan River is situated fifteen to eighteen miles north of San José, the capital of the country, and include three volcanoes which may be regarded as active. Of these, the one nearest the San Juan is named Poas. It is forty miles due south of the junction of the Rio San Carlos with the San Juan, and about fifty-eight miles from the proposed location of the eastern locks.

About thirty miles southeast of Poas is Irazu, the most active and forcible of all the Costa Rican volcanoes. It is about fifty-eight miles from the junction of the San Carlos and a little more, say sixty-two or sixty-three miles, from the eastern locks. About six miles east of Irazu, and substantially the same distance from the Canal, is Turialla, also an active vent.

The other volcanic chain is much longer. It lies near the Pacific coast, being only twelve to fifteen miles distant from Puntarenas. It extends in a northwest direction as far as the Volcano Orosi, which is thirty-eight miles southeast of the town of Rivas. It contains but one or two cones which may be regarded as active, though there are in all four or five which have at times disclosed some traces of volcanic action, but hardly enough to warrant us in calling them active. The Volcano Orosi, which is the northwesternmost of the chain and much nearer than any other to the Canal, is not positively known to be an active vent; certainly it has given no sign within the memory of men now living in its vicinity. Nor does it have the appearance of an active cone. I was within eight miles of it on the northern side, whence it seemed to be an old cone in an advanced stage of degrada-

tion by weathering, and no traces of recent action were visible. I have been unable to find any record of an eruption from it. Yet it is reputed in the works of several writers to be active, though no dates or incidents of such an occurrence are given, so far as I have been able to learn.

Nicaragua contains a single chain of volcanoes parallel to the Pacific Coast and generally about twenty miles from it. The southeasternmost cones of this chain are the twin peaks Madera and Ometepe in Lake Nicaragua. They are about fifteen and eleven miles respectively from the shore of the lake, and opposite the point at which the Canal will leave it leading to the Pacific. Madera is apparently extinct, but Ometepe is active, having been in eruption in 1888. The proximity of these two cones to the Canal makes them objects of special interest, for they are much nearer to it than any others. The next volcano of this chain is Mombacho, at the foot of which the large town Granada is situated. While there has been no eruption from it during the history of Nicaragua, there are some lava-streams emanating from it which bear the look of recency, and cannot be more than a very few centuries old. It is also one of the principal sources of earthquakes and tremors. Its distance from the Canal locks near Brito is, I believe, a little over forty miles.

About a century ago a considerable eruption occurred near Masaya, some sixteen or eighteen miles beyond Granada. From the meagre accounts preserved, it would seem to have been attended with very little violence, though a very considerable body of lava was ejected and overflowed a large tract of country. This quiet form of eruption is sometimes seen elsewhere among basaltic outbreaks, and is especially characteristic of the vast lava floods of Mauna Loa and Kilauea in the Island of Hawaii. There is no mountain or even large cinder cone to mark the orifice of the Masaya eruption which was situated in a comparatively low country.

There is a group of volcanic cones on the southwest shore of Lake Managua, near the city of Managua, but they appear to be extinct. No other active volcano exists in this chain, until Momotombo, at the extreme western bay of Lake Managua, is reached. It is a large cone, and is always steaming at the summit, and gives evidence of a dormant activity in many ways. It is reputed to have erupted twice during the present century, the last time only a few years ago. Twenty miles northwest of it and north of Leon is the Volcano Santa Clara, which is also steaming, but as these two are more than one hundred miles distant from the Canal, they may be regarded as outside the limits of discussion.

In only one instance has any eruption in Central America been of the extremely violent class. The exception was the outbreak of Coseguina on the Bay of Fonseca in 1835, which was one of the most forcible of the present century. Otherwise the eruptions have been of small or moderate energy, causing no serious and widely spread disasters. The ejections are largely in the form of scoria and ashes, though lava streams sometimes flow.

As regards earthquakes, it is well known that they are comparatively frequent, especially in Costa Rica and Nicaragua, and a few have been destructive in very restricted localities. It is no doubt a matter of great interest to the Canal Company; for the question at once arises whether there is not danger of serious damage from this cause to the works of construction, and of the still more serious damage of long suspensions of traffic. In order to reach some estimate of the magnitude of this danger, it may be well to state, as briefly as possible, some general considerations which must serve for a logical basis of any estimate:

(1) The forecast of earthquakes contemplates probabilities only and not certainties. That one will happen in a particular region in a specified number of years, is a probability which is great or small according to the nature of the locality and its extent. We may view such probabilities as having the nature of risk analogous to those of fire and shipwreck, with the following difference: Fires and shipwrecks are of such frequent occurrence, and have been so thoroughly investigated by insurance companies, that their probabilities under widely varying circumstances can be estimated with great precision, and the commercial value of the risk accurately determined. Earthquake risks have never been so investigated, and it is therefore impossible to assign specific numerical values to them. Nevertheless, it is sometimes practicable to show that the risk is so small that it can be left out of consideration with prudence, though we may not be able to assign its precise value.

(2) In attempting to forecast the future probabilities of earthquakes, we must assume that the future will be like the past, precisely as is done in insurance probabilities. We must assume that where they have been frequent and violent they will continue to be so, and that countries seldom visited by them in the past will be as seldom visited in the future. There is no other possible basis of reasoning.

(3) Earthquakes originate at very different depths in the earth, rarely, perhaps never, exceeding twelve miles, and generally not exceeding three or four miles. We know almost nothing of the ultimate nature of the forces or causes which generate them; but we know considerable about the manner in which they are propagated after they have been started, and concerning their subsequent action and effects. Whatever may be the causes, we must assume that the subterranean track or seat in which they originate occupies some space of very limited extent and contains some point which may be regarded as its centre, —commonly called the *centrum*. From the seat of origin the impulses are propagated as elastic waves in every direction, in a manner having much in common with waves of sound in the air.

(4) The intensity or violence of these waves diminishes like that of the air, at as rapid a rate as they are propagated. At any given spot the intensity is inversely proportional to the square of the distance from the centrum.

(5) In all destructive earthquakes, the extent of country in which they are destructive is but a small fraction of the total area throughout which the tremors are perceptible. Ordinarily it is not far from the four-hundredth part of the area perceptibly shaken. The area in which the shocks may cause damage varying from slight to serious (but not demolition or what are usually considered destructive effects) is commonly about four to eight times as large as the destructive area, or from the fiftieth to the one-hundredth part of the area of perceptible vibration. Those ratios are only roughly approximate, and they are subject to some qualification, ordinarily not large, dependent on the depth of the centrum. They are of importance as showing the comparatively narrow localization of destructive and even damaging effects. Still, the destructive areas may in some cases be absolutely considerable, being proportional to the *total energy* of the shock at the centrum. The destructive area of the Charleston quake had a radius of not far from forty miles, but its tremors were perceptible at a distance of seven hundred to one thousand miles. Its great extent, as well as the distances at which its tremors were felt, cause it to rank among the most powerful shakes of the present century. Its intensity at the surface, however, while formidable, was not so excessive as has been experienced in some other memorable earthquakes. This was because its depth was extreme, being in all probability one of the most deeply seated of which we have sufficient knowledge to form an opinion. In striking contrast was the Casamicciola earthquake, on the Island of Ischia in the Bay of Naples, in 1884. Here the destructive area had a radius of less than two miles, but within that area the violence was superlative and the havoc great. At Naples, twenty-five or thirty miles away, the shock was only a faint tremor. The depth of the Charleston quake is computed at about twelve miles, with a very moderate probable error. The Casamicciola quake had its origin at a depth probably of less than half a mile. Immediately over the centrum its intensity was apparently quite equal to that in the central area of the Charleston, but the total energy of the shocks was hardly one seven-hundredth part as great. These two extreme instances may illustrate the varying effects of total energy and depth upon surface intensity. The comparison is analogous to one on a smaller scale between the explosion of one hundred pounds of dynamite at a depth of one hundred feet, and of thirty tons at a depth of half a mile. The effects at the "epicentrum" (point on the surface vertically over the centrum) would not differ much, but the larger and deeper charge would effect a vastly greater area, and would be felt at a much greater distance.

The foregoing will suffice for our purpose, and it is needless to enter into a general discussion of the principles involved in earthquakes. It only remains to put those already set forth into relation with the facts presented in Nicaragua and Costa Rica.

In both of these countries, the principal earthquakes, so far as we know them, and perhaps we may say all the forcible ones, have had their centra in close proximity to the volcanoes or underneath them, and are incidents apparently of the volcanic activity. There is no evidence nor any suggestion, so far as I can ascertain, that any of them have origi-

nated at a considerable distance from the volcanoes. The country on either side of the volcanic chains has not been visited by any earthquake shocks, except such as have been transmitted through the rock from the centre within the volcanic areas.

Earthquakes are frequent in the vicinity of San José, the capital of Costa Rica, and of the other towns surrounding it upon the high, fertile and populous plateau of this country. A very few of them have been more or less destructive. By far the most energetic one occurred in 1841, completely destroying the large town Cartago, situated at the base of Irazu, and killing many people. The intensity or violence of this quake, in close proximity to the centrum, appears to have been very great. But the indications, from the imperfect accounts we have of them, are to the effect that the intensity declined with increasing distance at a very rapid rate; for at San José, only thirteen miles distant from Cartago, the intensity hardly reached the destructive stage, and the injuries to the buildings were seldom great. In towns somewhat more remote the shocks caused great terror, but no serious damages, while at a distance of forty miles or more they appear to have been harmless. These accounts are very characteristic of the Casamicciola type of earthquake, involving a shallow centrum, a rather small "epicentral tract" with high intensity (because of the shallowness of the origin), and a rapid decline of intensity with increasing distance, because of a relatively small or moderate amount of total energy. The accounts of other earthquakes in Costa Rica, which have occasioned serious damage or destruction, are very meagre. But their general tenor is indicative of similar characteristics, but of less total energy. In general, it may be said that the earthquakes of that country appear to be very local in their destructive effects, and the shocks become harmless quivers or tremors within twenty to thirty miles of their origin.

The portion of the Canal between Ochoa and the Caribbean is, in my opinion, too remote from the localities in which the Costa Rican earthquakes originate to be liable to any serious injury from them. At long intervals of time, averaging, perhaps, from five to ten years, some exceptionally powerful shock may transmit waves as far as the Canal with sufficient intensity to produce marked vibrations and tremors; but that they will have force enough to materially injure the structure of the Canal is in my judgment too improbable to call for any special precautions against them. Very light and barely noticeable tremors will be much more common. If it could be shown that strong shocks have had their origin near the line of the Canal, the danger would be much more pronounced. But I am not aware that there is any indication whatsoever of such an occurrence. It is true that light tremors have been noticed in Greytown, but they are in all probability the vanishing waves of forcible shocks originating far to the southward. There is no reason to suppose that the country through which this portion of the Canal extends is an earthquake country. The risk of damage from that cause I regard as immaterially small.

With respect to the portion of the Canal leading from Lake Nicaragua to the Pacific there seems to be a somewhat larger risk, but not large enough to cause any serious apprehension. The Volcano Ometepe in the lake is only about thirteen miles from the outlet of the Canal, and about twenty-one miles from the locks. Its eruption in 1888 was a somewhat forcible one, attended with strong tremors, which sufficed to produce some cracks in the houses and area walls in Rivas.* I saw several of these cracks, though they were not common and in no case endangered the structures. The Canal locks, if they had been in existence at the time, would probably not have been injured, if built on rock foundations or upon very solid earth not liable to slip or settle under a series of such tremors. The tremors there were considerably lighter than at Rivas, and they would be much less susceptible of damage than the fragile walls of which Central American houses are built. A few cracks in a large town indicate a fairly definite degree of intensity, and give a far better measure of it than the terror and panic of the inhabitants.

Although the eruption of Ometepe in 1888 was the first since the conquest, earthquakes have before emanated from it, and some of them have been as forcible as the one spoken of, but none, so far as can be ascertained, that were measurably more so.

With regard to the possibility of earthquakes originating from Orosi†, we have no sufficient data to warrant any very definite opinion. It stands in a wilderness which

* Rivas is about half way between Ometepe and the locks.

† In Costa Rica.

has always been little inhabited except by Indians, and if any earthquakes have originated there, the shocks were so enfeebled by the time they reached the settled portions that they were harmless. Nor would it be practicable for a people unobservant in such matters to ascertain their source, or to collate from an uninhabited country the facts which would enable others to determine it. As this volcano is situated forty miles from the Canal locks, it would require much more decisive indications of seismic activity in its neighborhood than we now know of to justify any fears from it. To all appearance it is a long extinct volcano, not likely to trouble the world again with any eruption or violent shakings.

The Volcano Mombacho* is a centre of decided earthquake activity. A very few years ago—the exact year I do not recall—the city of Granada at its base was severely shaken, many houses being damaged and a number of them wrecked. A large church nearly ready for the roof was badly shattered. A few lives were also lost. This shock was felt forcibly at Managua, about thirty miles distant, and, though it caused much alarm and even panic there, it does not seem to have produced any serious damages. At Rivas†, which is about twice as far from Mombacho as Managua, it was harmless, though causing much alarm. It requires only a light and harmless shake, but one perceptible to everybody, to cause great fear and even panic. Other shocks, some of great force, have been known to emanate from Mombacho. This seismic centre, however, is too remote from the Canal to be a source of any apprehension.

No shocks are known ever to have originated along the line of the Canal from the lake to Brito, nor in any dangerous proximity to it, except those from Ometepe. This section of the Canal does not in reality lie within the volcanic axis or areas. The Nicaraguan chain, beginning with Madera and Ometepe, is a little to the north of it and the western Costa Rican chain ends with Oroquieta. The nearness of Ometepe‡, however, would be a source of danger, were it not for the fact that the past behavior of the volcano has been for more than two centuries so moderately demonstrative as to give little cause of apprehension of more vigorous action in the future. Unless future shocks from it should be much more powerful than in the past, they will not endanger the locks; and there is nothing else on this part of the line which an earthquake would be likely to injure.

There is a tendency on the part of nearly all persons who have not made special study of the subject, to entertain exaggerated ideas of the risks and dangers of what are termed earthquake countries. The terrors of the "epicentral tract" in a great devastating series of shocks cannot, indeed, be exaggerated. The error consists in assuming them to be frequent, widespread and typical of the country. In truth, they are rare, even in the most afflicted region, and when they do come they are destructive within relatively narrow limits only, while the country at large is shaken only by harmless quivers. It is exceedingly rare for one generation living on any spot on earth to have seen two destroying earthquakes in the same locality. In many volcanic countries there are a few spots where such catastrophes repeat themselves, though usually after very long intervals of years. These are known and can be shunned by the engineer and architect, if need be. Apart from these, all localities within an earthquake country sufficiently removed from the known centres or axis may be regarded as being in far less peril from earthquakes than from sweeping destruction by an uncontrollable fire.

Briefly, then, my opinion is that the risk of serious injury by earthquakes to the constructions proposed for the Pacific section of the Canal is so small that it ought to be neglected alike by the Maritime Canal Company, the Construction Company, and by contemplating investors; also that the risks to the Atlantic section are still smaller than those to the Pacific section.

You suggest that I submit "some observations upon the subject of the effects upon engineering super-structures and sub-structures of those earth movements which in some instances have destroyed cities and populations, changing topographical features of localities, and, on the other hand, movements which have destroyed in some instances massive works and have passed harmlessly others of seemingly frail construction."

* In Nicaragua, 35 miles north of the Canal line.

† Rivas is between Mombacho and the Canal.

‡ Ometepe is 23 miles distant from the locks.

Observations of the effects of great shocks upon buildings of many kinds are very abundant, and have been carefully made and studied. It may be said in general that super-structures of stone or brick are far more liable to injury than sub-structures, excepting in those transcendent quakes which nothing, not even the earth mass itself, can withstand.

In shocks which are less than superlative, though still destructive, foundations are seldom much injured, even when super-structures are extensively demolished. A super-structure is liable to cumulative vibration, *i. e.*, to oscillations of steadily increasing amplitude, while a sub-structure is not. Any ordinary walled structure is liable to have, either as a whole, or in some of its parts, a definite vibratory period. If this period be the same as, or a small but exact multiple of, the period of a series of earthwaves, the extent of vibration will rapidly increase, and the liability to destruction is greatly multiplied.

A sub-structure can have no greater amplitude of movement than the ground itself. Only in the most formidable earthquakes are foundations likely to suffer, except, perhaps, incidentally and secondarily from abnormal strains thrown upon them by the rocking of the super-structure. The escape of fragile structures, while strong ones are overthrown, is not a mystery. They are not in harmony with the wave period, and therefore not liable to cumulative vibration.

There is a mistaken impression prevailing among those who are unfamiliar with recent progress in seismic investigations, which it is important for engineers to be advised of. It is a common impression that earthquake motion has a definite direction in each case. There is no warrant for this in theory, and the seismograph wholly disproves it. There is no one direction of motion to a particle on the ground during an earthquake. The motion is in every direction. Perhaps I can best express it by saying that the ground squirms and wriggles. The path of an earth particle during a shake is like a long hair rolled up into a ball between the flattened palms of your hands, or like the path of a fly hovering under a chandelier. Still, it is usual for the components of all the motions to have some slight, and sometimes a very marked, predominance in one direction. The vertical components are generally smaller, except in very close proximity to the epicentrum, where they may become very large. Away from the epicentrum the largest horizontal component will more frequently, but by no means always, be in a line connecting the place with the epicentrum, or nearly in that direction. But the maximum vibration may be in any direction, being determined probably by accidents of the ground. It would be illogical, therefore, to attempt to fortify against earthquakes by building structures calculated to resist movements coming from any specific quarter, unless, indeed, it be decided to follow the example of the deacon in building the "One Horse Shay." The only precaution I know of, which is of the slightest utility, is to build on solid rock instead of sub-soils, gravels or any sort of unconsolidated strata. The amplitude of motion during a quake is less, and there is less liability to permanent displacement. But in the visitation of a first-class earthquake even this precaution would be useless.

The structures most easily injured would undoubtedly be the locks. The masonry might be cracked by a powerful shock, but unless the ground beneath were permanently displaced, or the walls moved bodily, the damage could be repaired at small cost. The gates might be jammed or broken or slightly displaced also. But shocks of sufficient severity to produce any of these results, are hardly to be anticipated. The dams, if built in the manner proposed, of loose rock with very long slopes (6 or 8 to 1), would require shocks of extraordinary power, accompanied with considerable displacement of the ground beneath them, to damage them. As against earthquakes, they would be the safest that could possibly be built.

Being already nothing but shattered fragments, it is not apparent what more an earthquake could do, except to dislocate the earth beneath them. Such permanent distortions of the earth do not occur except in the most forcible convulsions, far more forcible than any that have ever been known to occur in Nicaragua.

Very truly yours,

C. E. DUTTON, Major,
Ordnance Department, U. S. Army.

APPENDIX X.

STATEMENT

BY THE HON. WARNER MILLER, PRESIDENT OF THE NICARAGUA CANAL CONSTRUCTION COMPANY, WHO MADE A CAREFUL INSPECTION OF THE WHOLE CANAL ROUTE IN APRIL AND MAY, 1891.

The party reached San Juan del Norte, all in good health, on the 2d of April, and at once began inspection of the work already accomplished. The construction work has so far been confined to the harbor and the first few miles of land work. A year ago the harbor was entirely closed by the bar at the entrance. Our party, however, sailed in on the Carazo, passing over the bar, where at present there is a depth of 12 feet of water. This opening of the harbor has been accomplished through the work of the canal company, which has built the pier or breakwater, extending a distance of 1000 feet into the sea. The construction of this pier has operated exactly according to the calculations of the engineers, and the result has been, as I have stated, 12 feet of water on the bar at the present time. Commencing at San Juan del Norte, the line of the canal has been entirely cleared of the dense growth of tropical vegetation which covered it, for a distance of 10 miles; the trees have been all felled and burned. The actual excavation of the canal was begun about the 1st of January of the present year. One of the first of the American dredges purchased from the Panama Canal Company, the City of New York, was set at work. The company has six of these large and powerful dredges, which will be at work as fast as they can be set in order. Two of them are now at work, and three others will be ready in a short time. These dredges are the most powerful ever constructed, being capable of excavating to the depth of 85 feet. They raise material out of the cut and deposit it at a distance from the bank of the canal, so that the material does not have to be removed a second time. The two dredges now at work have already excavated the canal for a distance of half a mile to a width of 270 feet and a depth of 17 feet. Two other dredges will follow these, and complete the excavation to a depth of 30 feet, which is to be the depth of the completed work. The company has constructed from del Norte, parallel with the line of the canal, a railroad for the purpose of enabling it to transport men, material and machinery into the interior, so that the work may be begun simultaneously at several different points upon the line of the canal. This railroad is now completed a distance of 10 miles, and two miles more are graded and nearly ready for track laying. It has an equipment sufficient for its present service, and this will be increased as there is need, and the road will be extended to a point on the San Juan, called Ochoa, where the river is to be dammed. This dam will raise the waters of the San Juan to the level of Lake Nicaragua, and from that point to the lake, a distance of 65 miles, the river itself becomes part of the canal. The company has also constructed and is operating 60 miles of telegraph line between San Juan del Norte and Castillo, where our line connects with that of the Nicaraguan Government; the latter connects with the Ocean Cables, permitting immediate communication of the New York office with any part of the work.

After inspecting the work at del Norte and on the railroad, the party made a march through the wilderness near the line of the canal to Ochoa. This was a work of great difficulty, because the entire distance was through an almost impenetrable tropical forest. The only paths through this forest were those made by the engineers and surveyors. The distance was some 35 or 40 miles, which the party succeeded in covering in three days, thus examining the actual line of the proposed canal, enabling all the engineers to judge of the character of the work that had been done and the kind of material—rock and earth—that had to be moved. They were entirely satisfied with the examination.

At Ochoa the party took a steamer on the San Juan and went up the river to Lake Nicaragua. There they were transferred to the steamer which is employed on the lake for carrying freight. Before making an investigation of the western end of the canal—that part between Lake Nicaragua and the Pacific Ocean—the party went up the lake, a distance of something over 100 miles, to Granada, one of the principal cities of Nicaragua, and from Granada to Managua, the capital of the country, 80 odd miles, where several days were spent. We then took the steamer and went down the lake to Rivas, near which city the canal leaves the lake for the Pacific Ocean. The distance from the lake to the Pacific on this, the western side, is about 16 miles. The country there is generally cleared, settled and cultivated. On this account the party were enabled to make the investigation of the line on horseback. Three days were spent here in examining the line of the canal, from which the forest has almost all been cleared. The point where the canal leaves the lake for the Pacific is the terminus of the line which presents the fewest obstacles to the cutting of the canal. The highest point on this line is only 43 feet above the water of the lake. No difficulties of any kind present themselves on this side; it is simply a matter of removing a certain amount of earth, and the three locks which are to be built will bring the canal down to the level of the Pacific.

The entire party were greatly pleased with their trip across the country, and all the engineers expressed themselves entirely satisfied as to the feasibility of the route and the perfection of the plans of the company's engineers. In addition to the several surveys of this route made by the United States Government since 1872, the present company has spent nearly three years of time and employed a large number of engineers in the field, and no work of any great magnitude has ever been so thoroughly surveyed and studied in advance of its execution as this.

The party expressed great satisfaction at the quantity, character and stability of the work that had been done at Greytown. In addition to what I have already mentioned the company has established machine shops and storehouses, built docks and wharves for unloading vessels and constructed fifty buildings, including warehouses, offices for engineers, quarters for the men, and railroad terminals, including locomotive houses and other structures necessary to carry on the work of the railroad.

Personally, I was much pleased with the condition of affairs. Of course, I knew before going that the work had been done, but after my examination upon the ground I found the results exceeded my own expectation.

In conclusion I must say that I am thoroughly satisfied of the entire feasibility of the plan for building the canal, and I believe the cost will be less than our estimates. All the work thus far, has been accomplished within the estimate of our engineers, and I have no doubt of the ultimate success of the enterprise.

Another close observer whose opinions are deserving of confidence, and who was of the party accompanying Mr. Miller in the inspection, is Mr. D. McN. Stauffer, the Editor in Chief of *The Engineering News* of New York. Mr. Stauffer is also a Civil Engineer of high reputation and large experience in the design and execution of extensive engineering works in the United States.

An extract from one of Editor Stauffer's articles in his journal, published after his return to New York, is as follows:

"At the time of our visit the main breakwater, commenced in December, 1889, extended about 1,150 ft. from the point of beginning. At the risk of repeating what has already been detailed in this journal in past issues, the work done can be described as follows: The total width of the pier is 42 ft., and the greater part is constructed by driving 12 piles across the width of the pier in bents 8 ft. apart. Each bent is capped by a 14 x 14 in. yellow pine timber secured to the piles by drift and screw bolts, and each bent is braced transversely by six 4 x 10 in. diagonal timbers, spiked to opposite sides of the piles. Securely bolted to these caps are eight 12 x 12 in. timbers running lengthwise with the pier. Along the two sides of the pier a solid wall is formed by driving piles between the bents and in-

side the box thus formed brush mattresses are sunk by loading them with rock. This filling is intended to extend above high-water mark, and, except at the extreme seaward end, these mattresses have already been filled solidly with sand, and the shore line on the windward side has been advanced in a long, flat curve 153 ft. since the date of beginning. A railway on the pier carries an ingeniously contrived jet-pile driving machine, and extends back, about one-quarter mile, to a wharf located in deep water on the lagoon. To prevent cutting behind the breakwater a wing-wall about 700 ft. long of sheet piling has been driven from the pier to the lagoon. As the sand is very hard, ordinary pile driving was practically impossible and the jet-pile driver has been used with eminent success.

The timber used in the piles and timbers of the breakwater is North Carolina pine creosoted. The first—and fortunately a small—lot of piles were treated to 14 lbs. of oil per cu. ft. These piles have failed badly, some of them being eaten half off by the teredo in their one year of service. Since then all timbers used contain 16 lbs. of oil per cu. ft., and so far there is no evidence of failure.

The immediate effect of the building of this pier, before any dredging was done, was the natural cutting by the sea of a channel to the westward of the pier, about 600 ft. wide and with 6 1-2 ft. of water at low tide."

APPENDIX XI.

ANNUAL REPORT OF CHIEF SURGEON.

Hon. Warner Müller, President Nicaragua Canal Construction Co.

DEAR SIR:—In submitting to you the first annual report of the medical department of the above company, I wish to say that, for the sake of future convenience, I have made this report embrace the period from September 1st, 1889, to December 31st, 1890.

On the former date there were in the engineering force of the company about five hundred officers and men located in various camps on the Deseado River, Eastern Divide and San Francisco River. On the beach at San Juan del Norte were located Camps No. 1, Francis, La Fé and Headquarters. Toward the close of the year 1890 the total number of employes had been increased to nearly 2,000.

There was in the company's employ at this time Drs. Barnum, Birt, Salinas, Johnson, Kuehn and Stubbert, located as follows: Dr. Barnum at Camp Carazo; Dr. Birt at Camp Menocal; Dr. Salinas on leave; Drs. Johnson and Kuehn at San Juan del Norte and visiting the camps on the beach.

Dr. Stubbert arrived on August 29th, and attended to the erection of a hospital on the beach near Headquarters. At this time a small building of about thirty-five by twenty feet was used as a temporary hospital. The services of Assistant Surgeons Johnson and Kuehn were dispensed with early in September, and Assistant Surgeon Stubbert took charge of all the work at Del Norte, including Headquarters, Camps No. 1, Francis and La Fé, Temporary Hospital and the erection of Headquarters Hospital.

The condition of affairs at this time, in so far as related to the medical work, was very unsatisfactory, the assistant surgeons in camp being poorly supplied with drugs, and those on the beach drawing their supplies from a local pharmacy owned by one of the assistant surgeons. Requisitions made on New York for a larger and more varied assortment were promptly filled, and since there has been constantly on hand a sufficient supply.

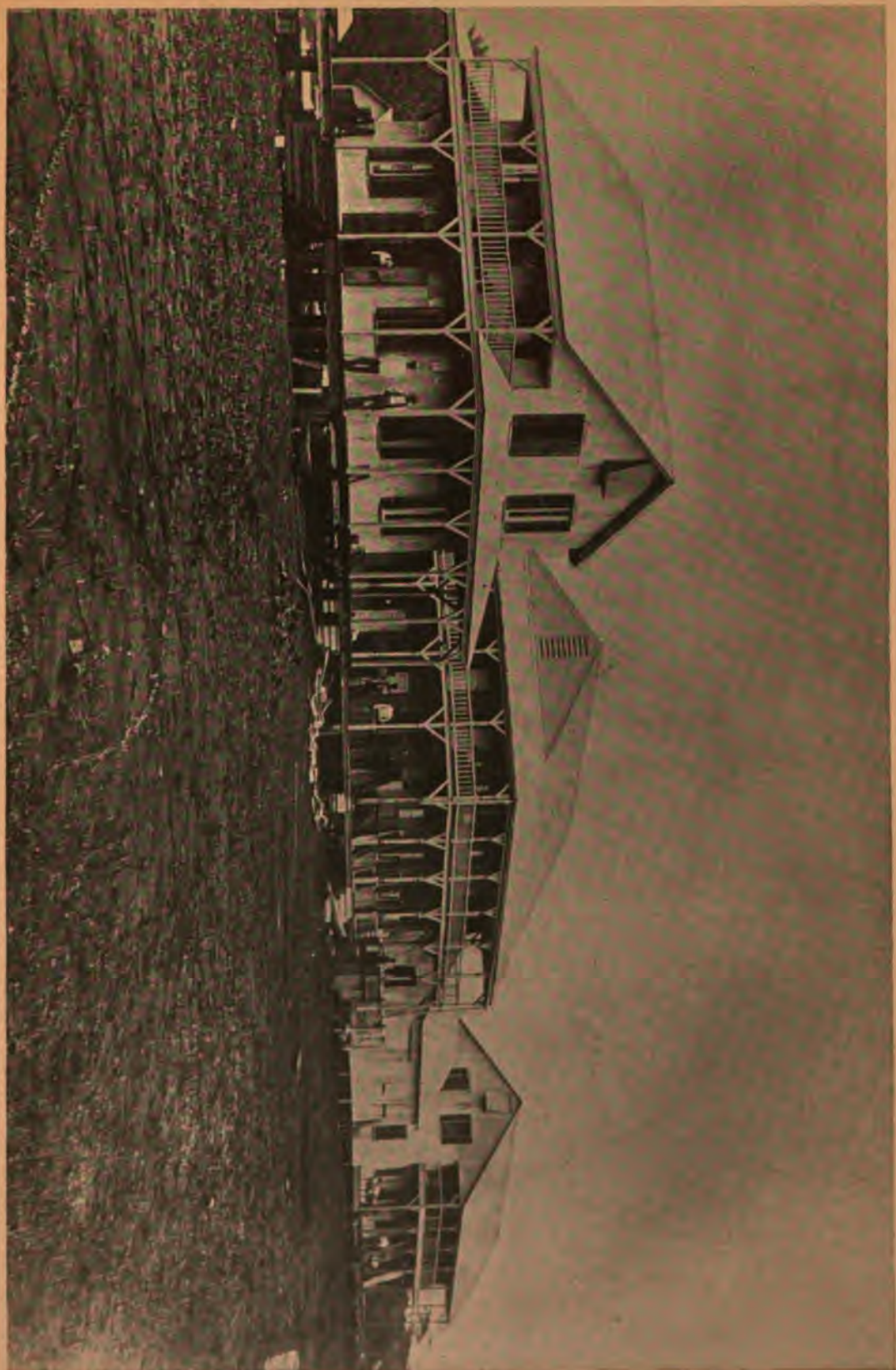
Headquarters Hospital at first consisted of one building accommodating about thirty patients, but, as its capacity was entirely inadequate, another building was erected for laborers. In October the Chief Engineer arrived from New York, and immediately commenced the construction of a large building for laborers' wards. During the year out-buildings have been erected to meet new demands or replace temporary shacks, and now the Headquarters Hospital consists of a group of twelve buildings to be enumerated later.

In the spring of 1890 Dr. Stubbert was promoted to Chief Surgeon, and Dr. Barnum to House Surgeon in August, 1890. W. S. Fox was assigned as Druggist in March, 1890, having served the company in that capacity without regular contract from September 1889. Dr. Kuehn was again employed from November, 1889, to December, 1890. Drs. Archer and Menocal entered the service of the company in May, 1890, Dr. De Soto in July, 1890, and Dr. Bigelow in October, 1890.

STAFF.

The Medical Staff of the Company on December 31st, 1890, was as follows :

J. Edward Stubbert, M. D., Chief Surgeon.	Walter M. Barnum, M. D., House Surgeon.
Oscar A. Menocal, M. D., Assistant.	Henry De Soto, M. D., Assistant.
Blake Bigelow, M. D., Assistant.	Sebastian Salinas, M. D., Assistant.
Walter S. Fox, Druggist.	Louis H. Birt, M. D., Assistant.



HOSPITAL BUILDINGS, LOOKING WESTWARD.

The work of the Medical Department is thus divided:

Hospitals, Medical Stations, Out-Patient Department, Sanitary Department and Druggist's Department.

HOSPITALS.

There have been in operation during the past fifteen months one permanent and two temporary hospitals. The first of the latter class was discontinued when the permanent hospital was erected, the other is still in use.

Headquarters Hospital is situated on the beach, nearly a mile west of the harbor. It consists of twelve buildings. No. 1 is a two-story house, used as living quarters for the House Surgeon, his assistants, and for the offices of the Surgeons.

No. 2. A large two-story building surrounded on both floors with broad verandas. In this building are the Hospital Pharmacy, Examining Room, Operating Room and eight wards for the use of invalid officers.

No. 3. A two-story building, containing baths and closets for the use of patients, water being supplied from a large tank of rainwater.

No. 4. A two-story building, the lower part being occupied as a druggist's store-room, while the second story is used for a linen room and sleeping quarters for the steward and some attendants.

No. 5. The mess-room.

No. 6. A large two-story building with verandas on both stories; it is used as the laborers' division, containing four large wards, baths, closets and a linen room.

No. 7. A one-story building, used as a kitchen, and containing also the steward's store-room and pantry.

Nos. 8 to 12 inclusive. One-story buildings used as stable, dead-house, laundry, drying house and barracks.

Owing to the mild climate, the use of overhanging verandas, and unglazed windows on all but the sea-sides of the buildings, it is here possible to provide much more perfect ventilation than can be obtained in northern climes, and therefore its capacity, referred to the number of cubic feet, is greater than would be supposed. The wards are furnished in a similar manner to those of well-regulated hospitals in New York. A corps of nurses, under a competent head nurse, attend the patients day and night. A well-conducted steward's department is under the care of an experienced man. The staff of the hospital consists of a House Surgeon and two assistants.

[MEDICAL STATIONS.

Seven miles and a-half out on the railroad line, and nine miles from Headquarters, is located a temporary hospital.

Stations have been established at points remote from the hospitals. They are generally located so as to be within easy communication of a number of camps, and as the latter are generally situated along a river course, this is comparatively easy.

There have been at different times during the period covered by this report, four of these stations, at each one an Assistant Surgeon, whose duty it was to visit at least twice each week every camp in the residency of his station and oftener if called upon in cases of emergency.

On the Pacific Division, as the work has been recently inaugurated, one station has been sufficient. Dr. Barrios, a native physician, located at Rivas, was employed to render such services as were required. Supplies of drugs, surgical dressings, etc., are sent from Headquarters Hospital as needed.

OUT PATIENTS' DEPARTMENT.

This branch of the work, while not apparently of much importance, is very useful in preventing the development of diseases among the employes, and to its careful operation is due most of the good results that have been obtained in preventing sickness and a high death rate.

At Headquarters Hospital, Temporary Hospital No. 1, and R. R. Camp No. 1, there have been out-patients' stations. This work has been carried on at the first-named place every day during the time covered by this report; at the second, daily during the time of its operation, and at the last, daily from the last week of May, 1890. The object of this branch of the work is to bring under observation of a medical man all employes who, while not sick enough to enter a hospital, are what they uniquely call "half sick." By this means very often the development of serious, if not fatal disease, has been prevented with the least possible loss to the company of hours of labor: and again, men who were really needing hospital care, and yet through ambition, prejudice or ignorance of the gravity of their condition were opposed to entering the hospital, have been compelled to yield to the judgment of the doctor, being thus saved from lingering illness, if not death.

SANITARY WORK.

Every possible precaution against the development of disease among the company's employes has been observed by watching for and removing all local causes and prohibiting the entrance into our camps from outside sources the germs of contagious or epidemic diseases.

With this object in view every surgeon is invested with the power of a sanitary inspector in his residency, and has orders to report to the Chief Surgeon anything in the location or building of a new camp that may be in his judgment likely to cause sickness among those employes located there. After a camp is built and occupied, he sees that hygienic rules are observed in its management, and is required to report to the Chief Surgeon every ten days upon the sanitary condition of all camps in the residency.

QUARANTINE WORK.

Situated as we are, on a coast at various points of which yellow fever is reported to be developed or existent every summer, and thus being exposed to this highly dangerous disease by steamers and numerous small schooners hailing from ports on this coast as well as the West Indies, it is obviously of paramount importance that this company should control absolutely the entrance of vessels to this port during the quarantine season. Recognizing the importance of this step, the Governor of the City of America was called upon to make such arrangements as seemed best and were possible for protecting our camps from outside sources of disease.

Owing to the fact that San Juan del Norte is the port of entry for ships consigned to the company, although all of our interests are located in the City of America, I was requested to meet the Port Surgeon and together with him draft such quarantine regulations as we deemed the circumstances required. This we did, and they were approved by the Governors of Del Norte and America. A Harbor Police Force was established whose duty it is to watch for all small trading schooners and stop them at the bar until they are examined and passed by a doctor.

Upon the recommendation of the Governor of America the government of the republic invested me with the title and office of Port Surgeon with the powers of Port Captain, thus placing the government police of America under my orders in quarantine and sanitary matters. An edict was published by the government to the effect that, between certain hours of the day I should have the right to enter any house in America for the purpose of sanitary inspection, and that all failures to carry out sanitary orders within a specified time would compel the government to do so at the owner's expense. Accordingly Quarantine rules were in active operation from the latter part of May, 1890, until early in October, 1890, i. e., until the United States authorities at New Orleans raised the quarantine against this coast.

DRUGGIST'S WORK.

At Headquarters Hospital is located the Druggist's Stores where all supplies from New York are received and kept, and whence all supplies for hospitals, medical stations or camps are distributed. At Headquarters Hospital is also a well fitted and stocked Pharmacy and at Temporary Hospital No. 1 there is a smaller one. In each Medical Station is always kept on hand a good assortment of drugs and surgical dressings, while for every subordinate camp a small emergency case is provided.

The Druggist has general supervision of both hospital pharmacies and the medical supplies in stations and camps. He receives and fills all requisitions after they have been approved by the Chief Surgeon. The dispensing of drugs in stations and camps is done by the Assistant Surgeon of the Residency. The Druggist keeps an account with each pharmacy and camp, so that at all times it is easy to ascertain the indebtedness and responsibility of any one of them.

AMBULANCE SERVICE.

At Headquarters Hospital there has been in operation since October, 1889, a very efficient ambulance service. Most of the time it has been possible to operate the Ambulance anywhere on the beach between the Hospital and Greytown, but since excavation of the canal has begun, La Fé and Headquarters are the only two points that can be reached. At the former, connections by boat are made with all points. Since the beginning of November, 1889, the Ambulance trips have averaged a little more than two per day.

FIRE DRILL.

At Headquarters Hospital a Fire Drill has been instituted during the past six months, nine stations having been established and every man detailed to one of these as on ship-board. Each station has buckets which are kept constantly filled with water. In addition to the water buckets are Babcock Extinguishers, ladders and axes. A system of signals for alarm, etc., have been posted at each station. The men are drilled at least once a week and have become very efficient. The time consumed between sounding the first alarm and having the stations reported as fully manned, varies from one minute and a quarter to two minutes. By actual and repeated experiments it has been found that within five minutes of the first alarm there can be emptied upon any point in the hospital enclosure thirty buckets of water, after which the buckets can be refilled rapidly.

STATISTICS.

We now come to the number of patients treated, classification of diseases, mortality, etc. The time covered by the statistical portion of this report will be from November 1st, 1889, to December 31st, 1890, as owing to the fact that until October 16th there was no recognized head to the department, no previous records are in existence. During these fourteen months there have been admitted into Headquarters Hospital 1669 patients, of which 1347 were Medical and 322 Surgical. Of the whole number there have been discharged cured or improved 1646. The total number of deaths has been 28 or 7.10 of 1 per cent. of those admitted. These deaths can be subdivided as follows:

Those due to accidents	5, or 1.3 of 1 per cent.
Those due to chronic diseases contracted before entering the company's employ	6, or 1.3 of 1 per cent.
Those due to diseases contracted while in the employ, i. e. CLIMATIC DISEASES	12, or 7.10 of 1 per cent.

This fact I wish to emphasize, viz: That out of over 1600 patients, only 12 have died from diseases that may be termed climatic.

It has been generally supposed that this country teems with fatal maladies, and that the employes are exposed to severe and dangerous types of fever. After a professional experience of ten years, most of which time has been spent in the tropics, and being familiar with nearly every climate of the globe, I can state that Nicaragua is exceptionally exempt from any fatal endemic disease.

To show how varied in character are the diseases met with and how closely they resemble in class those of a temperate rather than of a tropical clime, I will enumerate some of the most prevalent in this hospital.

Remittant Fever	208	Intermittent Fever	433	Pernicious Fever	6
Bronchitis	65	Cholorine	19	Pneumonia	17
Indolent Ulcers	38	Phthisis Pulmonalis	3	Dysentery	47

The disease which is most liable to prove fatal is Dysentery, but this characteristic of that grave disorder is the same in all climates. Most of the diseases met with have been mild in type, this being especially true of Bronchitis and Pneumonia, the latter frequently having its crisis on the sixth day. The cases of fever, when of the remittent or intermittent types, are very amenable to treatment and not of long duration; the former generally disappearing in about four and a half instead of twelve to fourteen days, its usual duration in the States.

No epidemic disease has visited the country since the company has been at work and the occasional rumors one hears of such visitations in the past, upon investigation lack sufficient evidence to give them credence. Two illustrations will suffice. During the summer of 1889 a great panic was caused by reported cases of Yellow Fever in Del Norte. The sequel proved them to be nothing more than a few isolated cases of a Pernicious Malarial Fever, in which Jaundice was a prominent symptom. In the summer of 1890 a number of cases of Chagres Fever and Adynamic types of Malarial Fever were brought to this port from Colon on towing steamers in service of the company; some of these were reported by the populace as cases of Yellow Fever. Every one of these admitted to our hospital recovered, while of those admitted to the Colon hospital a number died. Thus it is seen that not only are we not specially subject to fatal diseases but when aggravated cases of endemic disorders are brought here from other localities, the tendency is towards recovery.

CLIMATE.

The climate of Nicaragua is, as has been asserted, and we think proven by the record of this department, a salubrious one. Far removed from the severity of northern winters, even while geographically in the tropics, we enjoy an equable temperature throughout the whole year. The North East Trade wind tempers the atmosphere, and has a marked influence. The temperature had an extreme range of 18.5 degrees, from a minimum of 71 degrees to 89.5 degrees, or a mean of 77.25 degrees. The dredges have been at work in the harbor and in the opening of the canal line for some months without causing an increase in the percentage of illness.

IMMUNITY FROM SICKNESS OF OFFICERS.

Our experience in this respect has been eminently satisfactory. Two officers only have died; one a case of suicide, and the other killed by a falling derrick. The fact that not a single case of fatal illness has occurred among our officers, most of whom are brought here from colder climates and exposed constantly to the elements, working in swamps and dense forests, speaks for itself.

EXAMINING LABORERS SEEKING TO ENTER THE COMPANY'S SERVICE.

It is easier to prevent the entrance of diseases among our employes than to eradicate it when present; therefore no laborer is employed until he has passed a satisfactory physi-

cal examination. I have suggested the advisability of locating a member of the medical staff at Kingston, Jamaica, for the purpose of examining all men shipped thence by the company's agent.

Pending the execution of this recommendation, the agent in Jamaica was directed to have the men examined by local physicians. These examinations were unsatisfactory, either through ignorance or dishonesty, there being imposed upon the company numerous boys, chronic invalids and syphilitic men. Therefore I believe that, as the force is augmented, by far the most satisfactory and economical method will be to station one of our medical staff at Kingston, ship all laborers from that point, and have them examined at the time of embarking.

EXPENSES OF THE DEPARTMENT.

Attached to this report will be found an accurate account, in soles, of the running expenses during the year 1890. Sheet A shows the total expenses of the department as a whole during the year. Sheet B gives total cost of Headquarters Hospital.

Respectfully submitted,

J. EDWARD STUBBERT, M. D.,
Chief Surgeon, N. C. C. Co.

Headquarters
Nicaragua Canal Construction Co.,
San Juan del Norte, Nicaragua,
Feb'y 17th, 1891.

SHEET A.

TOTAL COST OF MEDICAL DEPARTMENT FOR THE YEAR ENDING DECEMBER 31, 1890.

Total interest on Headquarters Hospital Buildings for the year ending December 31st, 1891.....	2,507 75
Total interest on equipments for the year ending December 31st, 1890.....	1,649 11
Total cost of subsistence for the year ending December 31st, 1890.....	17,170 53
Total interest on surgical instruments for the year ending December 31st, 1890.....	144 61
Total salaries of officers and employes for the year ending December 31st, 1890..	19,703 80
Total cost of drugs used during the year ending December 31st, 1890.....	6,165 40
Total.....	\$47,340 69

SHEET B.

COST OF HEADQUARTERS HOSPITAL FOR THE YEAR ENDING DECEMBER 31, 1890.

Total interest on Headquarters Hospital Buildings for the year ending December 31st, 1890.....	\$2,507 75
Total interest on outfit for the year ending December 31st, 1890	1,649 11
Total cost of subsistence for the year ending December 31st, 1890.....	17,170 53
Salaries and wages of officers and employes for the year ending December 31st, 1890.....	14,050 80
Total cost of drugs used in Headquarters Hospital during the year ending December 31st, 1890.....	4,234 74
Total.....	\$39,602 93
Total number of days for one man in Headquarters Hospital during the year ending December 31st, 1890.....	14,496
Cost of one patient per day.....	\$3.80

METEOROLOGICAL REPORT FOR THE YEAR ENDING DECEMBER 31st, 1890.

HEADQUARTERS HOSPITAL,
February 14th, 1891.

MONTH.	TOTAL.	DAILY AVERAGE.	MAXIMUM TEMPERATURE.	MINIMUM TEMPERATURE.	AVERAGE TEMPERATURE.
	Inches.	Inches.			
January.....	26.80	86	81	70	75
February.....	6.36	227	80	72	76
March.....	5.98	191	81	73	77
April.....	18.11	60	78	72	75
May.....	4.98	164	80	72	76
June.....	46.84	155	84	74	79
July.....	52.55	169	81	75	78
August.....	85.72	115	81 1-2	75	78
September....	8.14	27	89.5	75	88
October.....	24.86	78	80.5	74	77
November.....	25.55	85	82	71	76.5
December....	41.65	184	81	72	76.5

1st—Average monthly rainfall for the year.....24.75 inches

2nd—Average daily rainfall for the year..... .819 inches.

3d—Total rainfall for the year..... 296.94 inches.

METEOROLOGICAL REPORT.

FOR PART OF YEAR BEGINNING JANUARY 1st, 1891, FROM RECORDS OF THE HEADQUARTERS HOSPITAL,
AMERICA, NICARAGUA.

MONTH.	TOTAL RAIN-FALL, INCHES.	DAILY AVERAGE, INCHES.	MAXIMUM TEMPERATURE	MINIMUM TEMPERATURE	DAILY AVERAGE.
January.....	14.16	.474	86°	74°	80°.
February.....	19.49	.62	88	75	79
March.....	23.57	.76	86.05	74	80.02
April.....	26.95	.87	85.5	74	79.7
May.....	13.78	.444	86	73	79.5
June.....	10.40	.347	81.67	77	79.67
July.....	1.95	.06	81.33	74	77.11
August.....	2.57	.09	80	72.67	76
September.....	20.30	.655	81	67	74
October.....	20.20	.65	95	72	77.5

Mean temperature 78.25 degrees.

Monthly average rainfall 15.34 inches.

Daily average rainfall 504 "

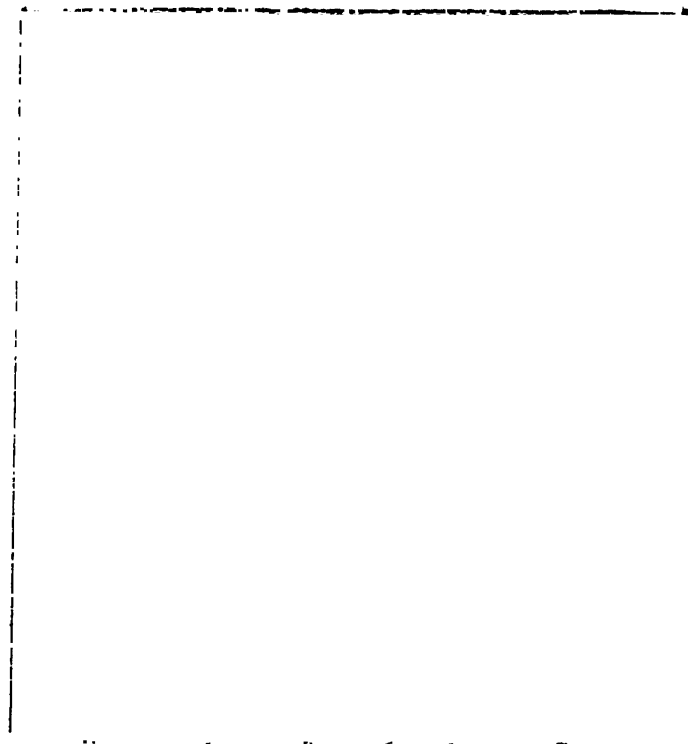
Compiled from the original record.

(Signed) GEO W. DAVIS,
General Manager.NEW YORK CITY,
November 30th, 1891. }

89090503855



b89090503855a



89090503855



B89090503855A